

EXPERIMENT STATION RECORD.

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EXPERIMENT STATION RECORD.

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Although more than half a century has now elapsed since the passage of the first Morrill Act, the question is still occasionally agitated as to the purpose and optimum development of the institutions established under its provisions. Criticism sometimes takes the form of assertion that the act itself is vague and prescribes no definite type of education. More frequently it is argued that a kind of high-grade vocational training was contemplated by the act, but that the agricultural colleges or individual institutions of the group are not fulfilling their appointed mission in that direction. In still other instances the relations of these colleges to other educational institutions or to the State system of education, the efficiency of their administration, or the formulation of a broad constructive policy for their future development have been the subjects of inquiry from various points of view.

The report of a special commission which has been studying some of these matters in Massachusetts has recently been issued, and appears to be of considerable general interest. This commission was authorized by the Massachusetts Legislature in 1916 for the purpose of investigating "the subject of agricultural education as conducted at the Massachusetts Agricultural College and the development of the agricultural resources of the Commonwealth." For some time there had been, in connection with the granting of appropriations to the college, more or less agitation as to the type of instruction it should give, its policies, and similar matters. While specific lines of inquiry were prescribed to the commission which had special reference to local conditions, most of the questions raised are common to the agricultural colleges as a group, and many of the findings of the commission are of much more than State-wide application.

The commission consisted of the State supervisor of administration and the State commissioner of education, together with three members designated by the governor. One of these, Dr. L. Clark Selby, president emeritus of Smith College and widely known in educational circles throughout the country, was made chairman. The remaining members were selected respectively from the agricultural and business interests.

Public hearings were held in several sections of the State, as well as conferences with representatives of various agricultural organizations, educational institutions, and similar bodies. A detailed inspection was made of the work of the college and a comparison of its management with that of other institutions. A committee attended the 1916 session of the Association of American Agricultural Colleges and Experiment Stations, and had interviews with many of the presidents and deans present and with officials of this Department, the U. S. Bureau of Education, and others. In short, the intention was to seek information from all available sources, and to make a thoroughgoing study from which could be formulated, with some degree of finality, conclusions as to the future policy of the State toward the college.

The commission gave special consideration to a determination of what should be the fundamental purposes and relative educational status of an agricultural college. It concludes that "the land-grant colleges were primarily established to promote the study of agriculture by the most advanced and scientific methods of instruction." Consequently, "the courses of instruction in the college should indicate an institution of a high grade for the teaching of scientific agriculture. In its distinctive field of agriculture it should be comparable with the Massachusetts Institute of Technology in its field of mechanic arts. No countenance whatever should be given to any suggestions that the agricultural college should be placed on the level of a trade or vocational school."

This attitude is specially gratifying because the contention of those primarily responsible for instigating the inquiry was that the college courses were too technical, and that the institution should be in effect a farm school. Similar views have been expressed in other quarters, and it is hoped that the conclusions of this commission may help to terminate controversy along this line.

The commission gives little credence to the conception occasionally met with that agricultural education is somehow inferior in its pedagogical requirements and value to other types of education. The policy early established and consistently maintained by the Massachusetts College of insisting on adequate preparation and high standards of instruction and scholarship is thoroughly approved. The commission declares that the standards of entrance "should be high enough to secure students capable of maintaining a high grade both in academic and scientific study. Without admitting that these entrance requirements should be the same as those adopted by the colleges of liberal arts, yet the commission believes that they should be of as high a standard. . . . The commission indorses fully the position of the college in requiring that its students shall be as well prepared for its

instruction as students are for advanced instruction in any other institution of higher education, and that the degrees it confers shall be of equal worth in their field with the academic degrees conferred by other colleges as certificates of attainment in other fields."

The relations of the college to the secondary schools of the State are also discussed. The agricultural college is regarded as "the last stage in a State-wide educational system for the advancement of agricultural science," and for this reason should be closely correlated with secondary schools where agriculture is taught. It is recognized that in such schools, and particularly those functioning under the Federal Aid Vocational Education Act, the primary aim is quite distinct from that of college preparation, and that agriculture will be taught there from a very different point of view. Nevertheless, the commission advocates the establishment of optional agricultural courses, so far as practicable, in public high schools, and where this is done, the granting by the college of the same credits as would be given in any other science. It is made plain, however, that other courses properly included in the high school curriculum should not be supplanted, but "should be so arranged as to make it possible for the student to secure a thorough and comprehensive training which will enable him to enter the agricultural college in good standing and at least with an elementary knowledge of the subject on which his future work will naturally be based."

With reference to the charge that the college has been offering too general an education, the commission reports that substantially three-fourths of the students are giving three-fourths of their time to distinctively agricultural subjects. It finds that science occupies by far the most prominent position in the curriculum, with fifty-four members of the faculty engaged in instruction in agriculture and the natural sciences and only fourteen in the humanities and mathematics. So far from the existence of any trend away from agricultural work, it was brought out that there is rather a prevailing tendency among the undergraduates to "elect studies according to their supposed commercial values and to neglect those studies which aim to strengthen and cultivate the mind." The commission does not specifically condemn this tendency, but it points out that, "while the State in its acceptance of the provisions of the Morrill Act is bound to give special instruction in agriculture, it is not less bound by the language of the act to give a liberal education as an integral part of its distinctive work, and not to neglect or relegate to subordinate places those studies which experience has shown are best fitted to nourish and strengthen the faculties of the mind and which will enable men to do better work, whatever that work may be."

The familiar criticism that only a small proportion of the graduates become farmers, because of a lack of practical instruction, is

deemed entirely unmerited. It is shown that farm work is now required of every student and that a summer session has been introduced whereby such work can be carried on more readily. Of the total hours assigned to work in the divisions of agriculture and horticulture over two-thirds are given to laboratory and field work. Though the commission sees no necessity for imposing any arbitrary requirement of farm experience upon faculty members, a great majority of the instructing force in these departments have had such experience. "The lack of practical farmers, therefore, among the graduates does not appear to be due to a lack of practical work in agricultural instruction and can be more readily explained from other causes.

"Practical farmers the college does educate. They are found in all parts of the State, and they are conducting farms which are profitable to themselves and are profitable as object lessons. The important consideration, however, is that the college should train men who by their superior education and intelligence can make valuable contributions to the agricultural interests of the Commonwealth." The showing made by the college in this respect is commended as highly creditable.

The commission was apparently little impressed with the somewhat provincial complaint presented that many graduates from the Massachusetts College settled outside the State, which thereby lost the benefits of their work. It points out how largely the State college is indebted to the Federal Government for its support, so that "if its graduates enter into the service of other States it is only repaying the Federal Government for the aid it has received. All of the States are mutually indebted to each other for scientific knowledge, and it should be a source of congratulation rather than of complaint that the agricultural college here can pay to the other States something of its indebtedness to them." While the first and constant care of the college is the promotion of the welfare of agriculture in Massachusetts, there should be "the closest affiliation between the Federal and State agencies for the advancement of common interests, and every State college should work not only for the interests of its own State, but also for the promotion of agriculture throughout the United States."

The commission went quite fully into the administration and operation of the experiment station, having before it some criticisms as to the technical character of its work and publications, alleged delay in meeting popular requests for assistance in combating insect pests and plant diseases, and laxity in enforcing State control laws. The intelligent and broad-minded manner in which these matters are handled in the report speaks for the study given them and the generally creditable condition found to prevail in the station.

The work of the station is referred to as "one of the most important departments of the college," and one which has "richly contributed to the agricultural wealth of the State." Some suggestions are put forward as to the means of strengthening its research activities, among others relieving it entirely of the administration of control laws and providing for practically full-time service of its staff on experimental work.

The commission takes an enlightened view of the conditions and requirements of station work. It maintains that "the main work of the station should be carried on by highly trained experts who give practically all of their time to research. It will be conceded that research work, specially elaborate technical investigations such as are conducted by the experiment station, can be best accomplished by giving them the exclusive attention of the investigator. If the investigator's attention is diverted or interrupted by other work, his progress in his investigations is delayed in even greater proportion than is represented by the amount of time actually lost. . . . To a very limited extent the giving of instruction by the station may be advantageous, and it is perhaps detrimental to separate [station workers] entirely from contact with the ordinary work of the college, but, so far as is feasible, arrangement should be made to prevent their attention being diverted and their important work interrupted by other duties."

The establishment and maintenance of the graduate school, which "properly completes the work of the undergraduate college" is approved. The necessity for graduate training of specialists is recognized, and the provision of ample facilities and funds for its support is recommended.

The extension service is credited with having contributed much to the development of the farmer and to the agricultural wealth of the State. The desirability of close cooperation with other existing agencies for country-life improvement is set forth, and the commission believes that "the most logical and the most beneficial service the extension department has rendered has been in helping farmers in the improvement of agricultural methods." It recommends that it keep as closely as possible to that form of service, although there is nothing in the report which would preclude the college from studying rural problems in all their bearings.

The efforts of the college to coordinate its work with that of the State board of agriculture and other organizations interested in agricultural advancement and supported by the State are commended. As a further step in this direction the establishment by the legislature of a board for agricultural coordination is advocated. The duty of this board would be "to correlate the agricultural agencies of the Commonwealth, to supervise their respective publi-

cations, to prevent overlapping, and to secure the greatest efficiency and economy in their work."

The first need of the college is set forth as permanent and adequate financial support. "All of the other problems with which it is confronted can only be solved satisfactorily if requisite means are provided to meet the expense which their solution involves. Inadequate support means poor teachers, poor buildings, poor equipment, a second or third rate institution." The public is frankly advised that the college "will probably prove one of the most expensive institutions which the State maintains if it is to repay the State for its investment, and will grow more expensive the better instruction it gives."

Special consideration was given to a study of the best method of supporting the college. Of the four plans examined, that of millage appropriations, based on a fractional amount of the State's valuation, is deemed most advantageous to the institution, since in general it affords assurance of a certain relatively fixed income increasing with the advancing valuation of the State and with the developing needs of the college. The method chiefly followed in the past of annual appropriations based on estimates made directly to the legislature is characterized as unsatisfactory to both the college and the legislature, since it prevents the trustees from knowing sufficiently in advance what means they will have for the development of their plans, and has also apparently proved wasteful of the time of the college authorities and of the legislators.

A modification of this plan, which makes continuing specific appropriations to cover a definite period of years or until revoked, is deemed objectionable from the legislature's viewpoint because of its implication of a binding agreement upon subsequent legislators. If the appropriations are made for a fixed period, there is also "almost certain to be at the end of the period the kind of discussion of the college and its conduct that is not beneficial to it." The final plan studied, that of a general advance budget for all State institutions, "if carefully worked out and justly administered," is believed to be of great merit and applicable to the college.

The imperative need of several important buildings, additional improved live stock and other equipment, and more land is discussed in detail. An adequate and fireproof library building, to cost about \$250,000, and a commodious chemical laboratory, "furnished with the best facilities for chemical instruction and research," are deemed particularly necessary. A suitable gymnasium and armory, a dormitory system commensurate with the growth of the college, including provision for the increasing number of women students, and a greatly enlarged central heating plant are also recommended. The need of planning ahead on such matters is set forth, and the policy

is favored of increasing the power of the trustees in such matters as the purchase of land and erection of buildings, subject to the approval of the governor and council, rather than requiring specific authorization by the legislature.

No change is suggested in the present methods of appointment of trustees and members of the faculty. It is thought desirable, however, that an age limit of 68 years be established for all teachers or scientific workers on the staff. Legislation providing a system of retiring allowances for such employees who have been in the service of the college at least 15 years is recommended, to be administered either by the trustees or the State Teachers' Retirement Board.

The question as to whether the college is or is not a State institution is taken up. It is stated that practically there can be no question in the matter, but since the trustees form a corporation some technical legal questions have been raised, and legislative action is recommended to settle the matter.

In conclusion the commission considers the relation of the college to the development of the agricultural resources of the State. It is brought out that because of various economic changes the acreage of improved land decreased nearly one-half from 1880 to 1910 and there was also a heavy decline in the number of milch cattle. During the same period, however, the yield and value of cultivated land and the productivity of the cows have increased materially.

The college is credited with valuable service in this direction, particularly by teaching farmers how to readjust themselves to the altered conditions. It "has done much and it can do more to develop the agricultural resources of the State, in directing farmers into new lines of agriculture such as market gardening, fruit growing, greenhouse products, and by showing them how, by teaching new methods of fertilization and cultivation, the productivity of their farms can be largely increased. Farming in these days and in this region cannot be carried on profitably by old-fashioned methods. It must have the benefit of that advanced scientific and technical agriculture which the Massachusetts College was established to give."

The report of the Massachusetts commission thus contains much that is already familiar to agricultural educators, but not always understood and appreciated by the general public. It is a valuable statement of some of the fundamental relationships of the agricultural college and the State, embodying as it does the conclusions of a commission broadly constituted and with sufficient time at its disposal for mature study. While not all of its findings are of general application or would meet with universal acceptance, the report as

a whole should prove most helpful, both in clarifying the situation in Massachusetts and also as a careful, conservative, but withal a constructive conception of the present status and value of the agricultural college in the American educational system.

It establishes clearly the idea of a strong institution of high grade, supported liberally and consistently by the State, to work for the enlightenment and advancement of agriculture through instruction at college grade, through research and experiment of fundamental character, and through extension teaching.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY.

An introduction to theoretical and applied colloid chemistry, W. OSTWALD, trans. by M. H. FISCHER (New York: John Wiley & Sons, Inc., 1917, pp. XV+229, figs. 66).—This is an authorized English translation of the work previously published (E. S. R., 35, p. 8).

The action of aluminum chlorid on cymene, A. W. SCHORGER (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2671-2679).

Tannin content of Pacific coast trees, H. K. BENSON and F. M. JONES (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1096-1098).—Analytical data on western larch (*Larix occidentalis*), yellow pine (*Pinus ponderosa*), western hemlock (*Tsuga heterophylla*), dogwood (*Cornus nuttallii*), cottonwood (*Populus balsamifera*), and alder (*Alnus oregona*) are submitted in tabular form. An analysis was also made of a sample of Douglas fir which had been kept in a closely stoppered jar for one year. The tannin content had been increased 18 per cent. The total solids also increased, but a decrease in the nontannin material was noted.

From the data the authors conclude that Douglas fir slab wood selected for an extraction can be advantageously seasoned for one year. Western hemlock, western larch, and western pine seem also to yield extracts satisfactory both in quantity and quality. The dogwood appears to be suitable for an extract manufacture, but only as a dye.

The indigenous tans and vegetable dyestuffs of New Zealand, B. C. ASTON (*Nat. Agr. [New Zeal.]*, 15 (1917), Nos. 2, pp. 55-62; 3, pp. 117-128).—This is a general review and discussion of the subject, with references to the literature cited.

Comparative tests of chemical glassware, P. H. WALKER and F. W. SMITHER (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1090-1092, figs. 4).—Data obtained in tests made at the Bureau of Standards of the U. S. Department of Commerce on Kavalier, Jena, and five American-made wares, which included chemical analysis, determination of coefficient of expansion, refractive index, condition of strain, and resistance to repeated evaporation, to heat, to mechanical shock, and to chemical reagents, are submitted in tabular and diagrammatic form.

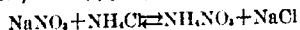
The results in general indicate that all the American-made wares tested are superior to Kavalier and equal or superior to Jena ware for general chemical laboratory use.

An efficient apparatus for frictional distillation under diminished pressure, A. NOYES and G. S. SKINNER (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2640-2649, fig. 1).—An apparatus which is considered to be highly efficient is illustrated by a diagram. The apparatus consists essentially of a Claisen flask which is attached to a separatory funnel and a fractionating column. The advantages claimed for it are that it may be used advantageously with either small or large fractions of material by regulating the flow of the entrant material from the funnel, and that the successive fractions may be introduced without losing the vacuum.

The solubility of silica, V. LENNER and H. B. MERRILL (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2630-2638, figs. 2).—Data on the solubility of silica in water and in hydrochloric and sulphuric acids are reported in tabular and graphical form.

The solubility was found to be definite and to depend on the temperature and concentration. With gelatinous silica, equilibrium was reached in a few hours or, at most, in a few days. Equilibrium could not be obtained with ignited silica in days or weeks. The solubility of the gelatinous silica was found to be the same regardless of the method of preparing the gel. The true solubility of ignited silica is deemed to be the same as that of gelatinous silica, but saturation is not reached in any short period of time. The apparent solubility is somewhat less than that of gelatinous silica.

Study of the preparation of ammonium nitrate by double decomposition between sodium nitrate and ammonium chloride, E. RENGADE (*Rev. Gen. Sci.*, 28 (1917), No. 17-18, pp. 489-503, figs. 4).—The author has studied the reaction



and has determined the optimum conditions for obtaining the largest yield of ammonium nitrate. The data are submitted in tabular and graphical form and discussed.

The nitrogen distribution in protalbinic and lysalbinic acids, GORDON KENNEDY and R. A. GORTNER (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2734-2736).—The authors, at the Minnesota Experiment Station, prepared protalbinic and lysalbinic acids by the action of alkali on egg albumin, and determined the nitrogen distribution in these substances, as well as in the original egg albumin, by Van Slyke's method (*E. S. R.*, 26, p. 22).

No marked differences were observed in the nitrogen distribution of these substances and the egg albumin. Both the acids showed a somewhat greater apparent lysin content than the original egg albumin. This is considered due to the presence of ornithin, derived from arginin by the action of the alkali.

It is noted that the results presented "furnish no evidence as to whether or not the protalbinic and lysalbinic acids are true chemical compounds or not, whether or not their chemical structure is more simple than is that of egg albumin. It is extremely improbable, however, that either preparation has as low a molecular weight as 800."

The effect of prolonged acid hydrolysis upon the nitrogen distribution of fibrin, with especial reference to the ammonia fraction, R. A. GORTNER and G. E. HOLM (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2736-2745, fig. 1).—The authors, at the Minnesota Experiment Station, hydrolyzed fibrin with 2 per cent hydrochloric acid for various periods of time, ranging from one hour to six weeks, and analyzed the resulting hydrolysates.

From the data obtained, it is concluded that the figures for ammonia nitrogen in an acid hydrolysate are not necessarily a true measure of the amid nitrogen in the protein molecule, but that they also include some ammonia derived from the deamination of certain of the amino acids, the extent of the deamination depending upon the length of hydrolysis. Monoamino acids are considered to be much more easily deaminized than the histone bases. Cystin is not the only amino acid which undergoes deamination when boiled with hydrochloric acid.

"The figures for arginin, histidin, and lysin in a Van Slyke analysis are not appreciably altered by a hydrolysis extending over six weeks, providing that tryptophan has been so altered that it does not precipitate on the addition of phosphotungstic acid. If it does precipitate it will be calculated as histidin."

Increases in the insoluble humin nitrogen, due to prolonged hydrolysis, are regarded as due to carbonization. It is noted, however, that there is no means of proving or disproving this hypothesis at present.

The data are presented in tabular form and discussed.

Some nitrogenous auxoamylases, E. W. ROCKWOOD (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2745-2752).—From experimental data submitted, it is concluded that both acyclic and cyclic compounds increase the power of the salivary ferment to hydrolyze boiled starch. In the cyclic compounds the action is the same whether the amino group is in the side chain or whether in the benzene ring. The salts from which the amino acids are derived do not have this action, thus indicating that the amino nitrogen is the activating agent. The position of the amino group in the benzene ring does not appear to cause any difference in activity. Acid amides, urea, etc., do not increase the hydrolytic power of the amylase. The sulphonic acid radical, when introduced into an amino compound instead of the carboxyl group, destroys the stimulating effect of the amino group. Imids do not possess this stimulating power.

Proteins are considered to act as auxoamylases toward ptyalin because of their nitrogen content, and as the number of free amino groups is increased by hydrolysis the activity of the hydrolyzed substances is also increased.

The amino acids appear to act as auxoamylases toward the pancreatic amylase also. Hence the amino acids produced in the intestine by digestive processes will act as hormones in starch digestion, and this factor should be taken into account in the study of normal digestion."

See also a previous note (E. S. R., 37, p. 204).

Analytical control of the ammonia oxidation process, G. B. TAYLOR and J. D. PETERS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1106-1110, figs. 2).—In the course of some experiments on the oxidation of ammonia for the production of nitric acid the authors have developed several analytical procedures for determining the course of the reaction. These procedures are described and discussed in detail.

A method for the determination of ammonia nitrogen with formaldehyde, J. H. C. VAN BERS (*Chem. Weekbl.*, 14 (1917), No. 42, pp. 968-975).—The following procedure for the determination of ammonia nitrogen in ammonium sulphate is described:

Five gm. of the ammonium sulphate is dissolved in water and the solution made up to 100 cc. and filtered. Ten cc. of the filtrate is transferred to a small Erlenmeyer flask, and 1.2 cc. of a 35 per cent formaldehyde solution (specific gravity 1.083 at 15° C.) and 10 cc. of $\frac{1}{10}$ -normal potassium hydroxide added. The flask is well stoppered, and the contents thoroughly shaken and allowed to stand overnight. Fifty cc. of boiled distilled water is added and the excess alkali titrated with tenth-normal sulphuric acid, using phenolphthalein as indicator. The proper corrections should be made for the acid in the solution and also in the formaldehyde. The percentage of nitrogen in the material is calculated by subtracting the number of cubic centimeters of tenth-normal acid, plus the acid found in the blanks, from the number of tenth-normal cubic centimeters of alkali used, and multiplying the difference by 1.562. If the quantity of nitrogen in the sample is less than 10 per cent some slight modifications are necessary.

The procedure is considered to yield as accurate results and to be less time consuming than the usual distillation procedure. The use of a burner is also eliminated.

The use and value of various indicators in ammonia titrations are briefly discussed.

The determination of potassium and sodium in the ash of vegetable substances, H. PELLET (*Ann. Chem. Analyt.*, 22 (1917), Nos. 7, pp. 146-152; 9, pp. 153-155).—To ash the material it is recommended to incinerate at a low heat

and extract the carbonized mass with water. The insoluble portion is then ignited separately and the ash added to the solution, which is evaporated and the residue gently heated.

For the determination of potassium and sodium 5 gm. of the ash is repeatedly extracted with boiling water and the extracts filtered into a 500-cc. flask. After thoroughly washing and cooling the solution to room temperature, it is made up to volume. To 200 cc. of this solution 50 cc. of a saturated solution of barium hydroxide is added in small amounts at a time with thorough shaking. After allowing the precipitate to settle, phenolphthalein is added and the solution treated with carbon dioxide until it is decolorized. Several cubic centimeters of a saturated solution of ammonium carbonate are added, the solution heated, filtered, the filtrate evaporated to dryness, and the residue ignited. This residue is extracted with water, the solution filtered, and the filtrates evaporated after the addition of hydrochloric acid. The residue of chlorides thus obtained is ignited at a low temperature and weighed. Ammonium carbonate solution may be used instead of the carbon dioxide for the removal of the excess of barium hydroxide. The barium hydroxide removes the carbonates, sulphates, and phosphates as insoluble barium salts and also the magnesium and titanium.

The potassium in the mixed chlorides is determined by precipitation with chloroplatinic acid. The filtrate and washings obtained by washing the chloroplatinates with a mixture consisting of 500 cc. of 80 per cent alcohol and 80 cc. of ether are evaporated to remove the alcohol and ether and boiled with an excess of ammonium formate. The reduced platinum is separated by filtration, the filtrate evaporated to dryness, and the residue ignited to expel ammonium salts. The ignited residue is treated with a few drops of hydrochloric acid, evaporated, and the sodium chloride thus obtained weighed after gentle ignition. The amount of potassium may be checked by reducing the potassium chloroplatinate with sodium formate and weighing the platinum black obtained.

The recovery of perchloric acid from residues obtained in the determination of potassium. A. VÜRTHEIM (*Chem. Weekbl.*, 14 (1917), No. 43, pp. 986-988).—The author describes a procedure for the recovery of perchloric acid from potassium perchlorate and from alcoholic filtrates containing the soluble perchlorates of sodium, magnesium, and calcium. The latter are dried and the residues used in the recovery. The procedure consists in treating the dry material with 97 per cent sulphuric acid and distilling at 170° C. under a reduced pressure of about 55 mm. The perchloric acid is collected in less than 100 cc. of distilled water. Some chlorine and also sulphuric acid are carried over into the distillate but are easily removed, the former by boiling the solution and the latter by precipitation with barium chloride. After the removal of these substances the acid is made to the proper concentration required for analysis.

The procedure has been found to be economical, especially in view of the present scarcity and high price of perchloric acid.

A rapid method for the determination of lime as calcium sulphate. L. G. WILLIS and W. H. MACINTIRE (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, pp. 1114-1116).—The following modified procedure is described by the authors at the Tennessee Experiment Station:

The calcium is carefully precipitated as oxalate, reprecipitated if necessary where the magnesium content is appreciable, and the precipitate ignited in a small platinum dish or platinum or porcelain crucible over a Bunsen flame or in a muffle until the filter is completely incinerated. For each approximate 0.2 gm. of calcium carbonate enough of a 1:1 finely ground and dried mixture

ammonium sulphate and ammonium chlorid to insure an excess of approximately 0.3 gm. of sulphate is added. The materials are thoroughly mixed in the crucible by means of a small glass rod. The crucible is now inserted in a circular opening cut in a piece of asbestos board placed horizontally, the upper edge of the crucible extending above the upper surface of the asbestos. A nearly horizontal flame from a small Bunsen burner is directed across the surface of the crucible in such a manner as to have the side of the crucible nearest the flame intensely heated. The conducted heat will effect volatilization without spluttering.

The procedure has been thoroughly tested and found to be reliable and especially well adapted for determining large amounts of lime and also in sets containing widely varying percentages.

A modified method for the determination of fluorin with special application to the analysis of phosphates, C. R. WAGNER and W. H. ROSS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1116-1123, fig. 1).—The authors have compared the various methods which have been proposed for the determination of fluorin in the presence of phosphorus, and have developed a procedure which consists in volatilizing the fluorin as silicon fluorid, collecting the latter in ether to form hydrofluosilicic acid, and titrating the acid with standard sodium hydroxid, using phenolphthalein as indicator. The apparatus necessary in the procedure and its manipulation are described in detail. In samples previously freed from water and organic matter (by burning) a complete analysis can be conducted in one hour. The method is indicated as being applicable to material containing as low as 0.01 per cent fluorin.

The sulphur trioxid, sulphur dioxid, and other products evolved, which may represent as hydrochloric and nitric acids, are removed by selective reagents through absorption so that a hydrofluosilicic acid entirely free from other acid constituents is obtained.

The mechanical analysis of soil, U. PRATOLONGO (*Staz. Sper. Agr. Ital.*, 50 (1917), No. 3-5, pp. 117-166, figs. 4).—The material reported is divided into three parts: (1) the problem and methods of the mechanical analysis of soil, (2) a new rapid method for the mechanical analysis of soil, and (3) experimental researches on a method of mechanical analysis by sedimentation.

The apparatus and the manipulation of the new method are described in detail and the experimental data reported in part 3 are discussed.

A note on a modified method for determining carbonates in soil, H. A. TERRY and R. E. KELSICK (*West Indian Bul.*, 16 (1917), No. 3, pp. 259-261, fig. 1).—A modification of the method previously described by Watts (E. S. R., 14, p. 848), which consists essentially in the substitution of an ordinary water filter pump for the mercury pump originally employed and in the use of an ordinary suction flask in place of a special receiver for the absorption of carbon dioxide by the barium hydroxid, is described. Comparative determinations with the original method show the modified procedure to yield accurate results and to possess a number of advantages.

Examination of water, W. P. MASON (*New York: John Wiley & Sons, Inc.*, 1917, 5, ed., rev., pp. VI+186, pls. 2, figs. 19).—This is the fifth edition of the well-known work previously noted (E. S. R., 23, p. 11).

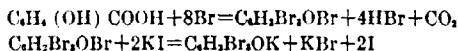
A volumetric method for the determination of formic acid or formates in the presence of hydroxids, carbonates, oxalates, and acetates, F. TSIROPINAS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1110, 1111, fig. 1).—A method, which is based on the quantitative oxidation of formic acid to carbon dioxide by chromic acid in boiling solution, and the necessary apparatus and its manipulation are described in detail. The carbon dioxide evolved is measured

in a suitable burette, and after reduction of the volume obtained to standard conditions the amount of formic acid is easily calculated.

In samples which contain carbonates, bicarbonates, oxalates, etc., these materials are removed by precipitation with a 10 per cent solution of calcium chloride and an aliquot of the filtrate oxidized as in the regular procedure.

Analytical data obtained in the analysis of pure solutions of sodium formate and solutions with the addition of carbonate, bicarbonate, and oxalate indicate that the method is accurate and reliable for technical determinations.

The determination of salicylic acid in foods, H. D. STEENBERGEN (*Chem. Weekbl.*, 14 (1917), No. 39, pp. 914-921).—A modified iodometric method is described which consists of treating the extract containing salicylic acid with a bromate-bromide solution and a $\frac{1}{100}$ -normal bromine solution, setting the bromine free with hydrochloric acid (specific gravity 1.13), and after 15 minutes adding an excess of potassium iodide and titrating the iodine set free with standard thiosulphate. The reactions taking place are indicated as follows:



Comparative analytical data of the usual acidimetric and the modified iodometric methods are submitted, together with data on the extraction of the salicylic acid from the original samples.

A new and simple procedure for determining the fineness of wheat flour, F. PERRACINI (*Staz. Sper. Agr. Ital.*, 50 (1917), No. 3-5, pp. 250-252).—A procedure which consists of treating a 5-gm. sample of the flour with 1 per cent copper sulphate solution and comparing the color which develops with a standard sample, similarly treated, is briefly described.

Some new methods for determining the fineness of flour, G. Lo PRIORE (*Staz. Sper. Agr. Ital.*, 50 (1917), No. 3-5, pp. 253-259).—The author discusses the colorimetric method previously described, and also a method based on the determination of the pentosans in the sample.

The conservation of tomatoes, P. GUARNIERI (*Staz. Sper. Agr. Ital.*, 50 (1917), No. 3-5, pp. 245-249).—This article deals with the organoleptic, physical, and chemical examination of tomatoes and the consideration of the analytical results obtained.

A note on the determination of the nonfatty solids in milk from the specific gravity at tropical temperatures, H. A. TEMPANY (*West Indian Bul.*, 16 (1917), No. 3, pp. 262-264).—A table showing the percentage of nonfatty solids in milk corresponding to lactometer readings at 30° C. (88° F.) has been constructed and is submitted, together with some analytical data which indicate the accuracy attained in the use of the table. The table was constructed to obviate the usual procedure of cooling the sample to temperatures required for the usual conversion tables.

A study of the estimation of fat in condensed milk and milk powders, C. H. BIESTERFELD and O. L. EVENSON (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1111-1114, fig. 1).—The authors have studied the usual errors inherent in the Röse-Gottlieb method and have compared it with a modified method in which a small amount of acetic acid, as an aid in separating the fat from the casein, mixtures of petroleum ether, ethyl ether, and ethyl alcohol (which are recoverable for repeated use), and a modified Röhrig tube (*E. & R.*, 16, p. 1050) are used. The two mixtures used in the modified method consist of (1) 400 cc. of petroleum ether, 200 cc. of ethyl ether, and 20 cc. of 95 per cent ethyl alcohol, (2) 350 cc. of petroleum ether, 280 cc. of ethyl ether, and 63 cc. of 95 per cent ethyl alcohol. The modified procedure is as follows:

In a modified tube from 4 to 4.5 gm. of evaporated milk or from 7 to 7.5 gm. of a 4 per cent emulsion of sweetened condensed milk are diluted to a volume of 20 cc. with water and, after mixing with 1.5 cc. of concentrated ammonium hydroxid, 15 cc. of 95 per cent alcohol is added and the whole mixed again. The mixture is then shaken vigorously for 2 minutes with 50 cc. of mixture 1. After standing for 10 minutes the fats are filtered through a 4-cm. Dreverhoff No. 55 fat-free filter paper into a 100-cc. Erlenmeyer flask, previously dried and weighed. The tip of the spigot of the modified tube and the paper are washed with a few cubic centimeters of mixture 1, and the funnel with the paper set aside for future use. The ethers are distilled on a hot plate, using cork stoppers covered with tin foil for connecting with the condensers, until approximately 4 cc. remains. The recovered ethers are returned to bottle 1 and the liquid in the tube mixed with 3 cc. of glacial acetic acid. The tube, immersed in water at 60–65° C. by a wire so that the tip of the spigot is just below the water, is heated to 80° in about 10 minutes. The tube is removed, cooled in running water, and shaken vigorously for about 2 minutes with 50 cc. of mixture 2. After standing a few minutes the ethers are filtered through the reserved filter paper into an unweighed 100-cc. Erlenmeyer flask, distilled, and returned to bottle 2.

This extraction is repeated with 50 cc. of mixture 2, and the ethers filtered into the same unweighed flask. The tip of the spigot and filter paper are washed with mixture 2 and the ethers distilled as before. The flask is freed from the residual liquid and acetic acid vapors and dried completely by heating on a steam bath while applying suction. The fat is then dissolved with 25 cc. of petroleum ether, using small quantities at a time, and filtered through the filter as before into the weighed flask containing the first extract. The petroleum ether is recovered, and the fat dried at 100° to constant weight and weighed.

From some work on the Harding-Parkin method (E. S. R., 29, p. 507) it is concluded that the higher results obtained with this method are due to the use of ether stoppers in contact with the solvents.

Analytical data obtained in the study show that the error of the Rösche method as applied to condensed milk is small, the average being about 0.1 per cent. The method may also give low results when applied to milk powder or cream. This error may be corrected by an extraction in the presence of acetic acid. The method described is considered to extract free fatty acids and more completely separate the fat from the protein, recovering a size of fat not obtained by alkaline extraction. The economy in the use of solvents is also noted.

Outline for the analysis of sugar products, H. LAJOUX and L. RONNET (*Jour. Pharm. et Chim.*, 7, ser., 16 (1917), No. 7, pp. 199–204).—The authors submit an outline for the examination of sirups, confections, honeys, etc., in tabular form which is deemed especially useful for routine examinations. Brief notes on details of the various procedures are also given.

A method for the determination of alcohol, C. J. HAINES and J. W. MARDEN (*Indus. and Engin. Chem.*, 9 (1917), No. 12, pp. 1126, 1127).—The following modified method is described:

Ten cc. of the alcoholic solution at 15.6° C. is measured into graduated tubes of 15 cc. capacity and potassium fluorid added until the volume reads 13 cc. A small crystal of malachite green is dropped in, which serves to color the alcohol clear so that the volume can be easily read. Other substances could be used, but the malachite green has been found to be very satisfactory. The tube is then closed with a tight-fitting stopper and shaken vigorously for about 2 minutes. If the potassium fluorid is dry, the solution warms up but when

placed in the centrifuge for 2 or 3 minutes cools to room temperature. The alcohol separates in the upper layer, while the excess of solid salt settles to the bottom of the tube. From the volume of alcohol observed and the volume of alcoholic liquid used for the determination, the percentage of alcohol by volume is readily found. Since 1 cc. of alcohol changes about 0.001 cc. per degree Centigrade at room temperature, the volume can be corrected to 15.6° if desired. When the readings are made from the bottom of the meniscus it is necessary to add 0.15 cc. to observed readings to allow for the small amount of alcohol not precipitated by the potassium fluorid and the amount of alcohol adhering to the sides of the tube.

Analytical data obtained on solutions of known alcohol content and on a number of commercial materials indicate the accuracy of the method. The procedure is not applicable to solutions containing less than 1 or 2 per cent of alcohol or to solutions in which other liquids, such as acetone, essential oils, etc., are present.

On the detection of methyl alcohol in alcoholic beverages and its formation by the several kinds of yeasts, T. TAKAHASHI, M. GUNKE, and T. YAMAZAKI (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2723-2726).—In the examination of the distillates of a number of alcoholic beverages, formaldehyde could not be found directly when the material was distilled below 80° C. After the oxidation, however, differences as to the quantities of methyl alcohol were observed according to the kinds of material examined. The smallest quantity was found in the case of "saké." In the case of a doubtful test, a large sample is recommended, followed by the redistillation of the distillate. All the kinds of yeasts tested (saké, beer, wine, and distillery yeasts) formed methyl alcohol in sugar solutions, the quantity increasing with the addition of glycerol as a nourishment.

A colorimetric method for the estimation of the cresol or phenol preservative in serums, E. ELVOE (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 110* (1917), pp. 25-33).—After some preliminary work the following procedure was devised:

Five-tenths cc. of the sample is measured out with a finely graduated and accurately standardized 1-cc. pipette, transferred to a 1,000-cc. Erlenmeyer flask, diluted with distilled water to about 275 cc., and then mixed with 25 cc. of diluted sulphuric acid (1 part H_2SO_4 , specific gravity 1.84, with an equal volume of distilled water). The flask is connected with a suitable glass condenser and the contents distilled until 200 cc. of the distillate is collected in a 200-cc. measuring flask. The distillate is filtered through a dry folded filter into a glass-stoppered bottle and then thoroughly mixed. To 5 cc. of the freshly prepared Millon reagent, in a narrow 50-cc. Nessler tube, 10 cc. of the distillate is added and the whole thoroughly mixed with a bulb glass rod. Four standards of trichresol solution are simultaneously mixed in a similar manner. The color which develops in the sample after standing for 10 minutes is compared with that developed by the standards.

Varying results were observed in using Millon's reagent prepared according to the directions given by various authors. The Millon reagent used in the work reported is prepared by treating 68 gm. of mercury in a 250-cc. beaker with 50 cc. concentrated nitric acid (specific gravity 1.405 at 25° C.). To the resulting solution 92 cc. distilled water is added and then 2.76 cc. concentrated nitric acid. The mixture is thoroughly shaken until the precipitate which often forms is completely redissolved.

Commercial evaporation and drying of fruits, J. H. BEATTIE and H. P. GOULD (*U. S. Dept. Agr., Farmers' Bul. 903* (1917), pp. 61, fig. 23).—This publication discusses in general the principles and methods of drying, buildings and

equipment for drying, evaporation of various fruits by artificial heat, equipment and details of sun drying, details as to the preparation of evaporated and dried fruits for market, insects injurious to dried fruits, and laws relating to evaporated and dried fruits.

Homemade fruit butters, C. P. CLOSE (*U. S. Dept. Agr., Farmers' Bul.* 900 (1917), pp. 7).—This briefly discusses and gives directions for preparing a few of the more common home products.

Contribution to the study of the viscous fermentation of beet juice, H. DECAVAL (*Ann. Sci. Agron.*, 4. ser., 5 (1916), No. 7-9, pp. 323-336).—The author has studied the morphology, optimum conditions for growth, character of cultures, metabolic products, effect of various influences on growth, and effect of viscosity on various microorganisms which are held responsible for viscous fermentation. The condition is indicated as being rather difficult to control, and the necessity of the complete sterilization of the utensils used in the fermentation is emphasized.

Contribution to the study of alcoholic fermentation, E. KAYSER (*Ann. Sci. Agron.*, 4. ser., 5 (1916), No. 7-9, pp. 297-322).—Experimental data obtained in a study of the production of alcohol from various raw materials are submitted and discussed.

Field tests made on oil treatment of wood against marine borers, C. H. TOSDALE and L. F. SHACKELL (*Engin. News-Rec.*, 79 (1917), No. 18, pp. 833-837, col. 6).—This is an experimental study of the value of various preservatives and methods of treatment. The results in general show that a proper creosote oil for marine work should contain a large proportion of constituents boiling above 320° C., as well as considerable amounts of high boiling tar acids and bases.

METEOROLOGY.

Agricultural meteorology, J. W. SMITH (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 75-92, figs. 5).—This article discusses what has been done and what it is considered possible to do in the way of coordinating meteorological observations with agricultural production, outlining especially the general program of the section of agricultural meteorology of the Weather Bureau of the U. S. Department of Agriculture. Some of the possibilities of this line of investigation are illustrated by results of studies made by the author on the correlation between temperature and rainfall and yield of spring and winter wheat and on the critical period for potatoes.

The economic aspect of climatology, E. L. WELLS (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 240-249).—This article briefly discusses some of the economic relations of climatology to agriculture, engineering, transportation, commerce, manufacturing, health and efficiency, recreation, and the like. A short bibliography of the subject is added.

Forecasts of weather favorable to an increase of forest fires, E. A. BEALS (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 257-270, figs. 8).—This article discusses the damage caused by forest fires in the United States, describes the weather conditions most favorable for such fires, and makes a plea for more extended study of such conditions with a view to improving the forecasts of wind as well as of other elements that cause an increase in the number of forest fires.

The meteorological influences of lakes, E. R. MILLER (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 189-198, figs. 9).—"The object of this paper is to call attention to the relatively important effects of the land and sea breezes

and of the monsoons of the Great Lakes of North America, notwithstanding the interference that their typical development suffers from the procession of cyclonic and anticyclonic eddies of the west wind belt."

It is shown in the paper "that lakes exercise an important influence upon the climate of their adjacent lands, even in the belt of westerly winds, where their influence is often obscured by eddy motions on a larger scale. Their influence is not restricted to the simple transfer of moist, cool lake air to the adjacent shores on hot summer days, or to the tempering of passing waves, but their influence extends, on account of the special phenomena of ascending and descending air currents, to regions far from the lake shores, where they cause heavier rainfall in the warmer months and clear, frosty nights whenever the land surface temperature is lower than that of the lake surface."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 4 (1917), Nos. 7, pp. [215], pls. 3, figs. 3; 8, pp. [215], pls. 3, figs. 3).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1917.

Meteorological records, E. BURKE (*Montana Sta. Rpt. 1916*, pp. 185-196).—Tabular monthly and annual summaries are given of observations at Bozeman, Mont., during 1916 on temperature, rainfall, cloudiness, and direction of the wind. Data are also given for monthly mean dewpoint, humidity, and vapor pressure from 1902 to 1916, and for daily evaporation and wind movement for June to October, 1916, inclusive. The highest temperature observed during the year was 90° F. July 7, lowest -33° January 27, mean 38.2°, last killing frost in spring June 12, first killing frost in fall September 14, total rainfall 21.19 in., greatest monthly precipitation 2.99 in. (May), rainy days (0.01 in. or more) 117, and clear days 155.

Report of the consulting meteorologist, J. F. VOORHEES (*Tennessee Sta. Rpt. 1913*, pp. 161-163, figs. 5).—Charts show the rainfall of Tennessee in 1913 compared with the normal, also the distribution of the rainfall in different parts of the State. It is stated that "the total rainfall for Tennessee in 1913 was only 1 in. below the yearly normal, but the distribution was such that its efficiency was far below the average. . . . The greater portion of the State had a wet winter and an early spring, followed by the driest growing season on record." The record emphasizes "the need for deep tillage, hedges, and a cover crop for catching, conserving, and using the rainfall."

Report of the consulting meteorologist, J. F. VOORHEES (*Tennessee Sta. Rpt. 1914*, pp. 285, 286, figs. 5).—Attention is called especially to the deficiency of rainfall throughout Tennessee in 1914, which did serious damage to spring sown grains, early corn, early potatoes, and other early crops, and emphasizes the advantage of sowing cereals in the fall as well as the need for tillage methods that promote the storage of the surplus rainfall of wet months for use during succeeding dry periods. The results secured in a continuation of a study of the relation of weather conditions to the growth of soy beans and corn carried on at 15 widely separated stations in the State are referred to, indicating "that there is a marked shortening of the period of growth with increase of temperature; that variation in rainfall has little or no effect on the length of time required for these crops to mature; and that there is some other very important factor whose influence increases as the season advances. This influence increases more uniformly and to a later date than air temperature. It is thought that soil temperature may be this other factor."

Report of the consulting meteorologist, J. F. VOORHEES (*Tennessee Sta. Rep. 1915*, pp. 130-132, figs. 2).—Charts showing the distribution of rainfall in different parts of Tennessee during 1915 are given and discussed.

The relation of July rainfall to the yield of corn in the State, for a period of 22 years, is also shown in a chart. "In addition to the marked relation shown by the chart there is another feature worthy of a little study. Dividing the record into two periods of 11 years each, it is found that the average rainfall for the first period was 4.63 in. and the average yield of corn was 22 bu. per acre. The average rainfall for the second period of 11 years was 4.78 in. and the average corn yield was 25.1 bu. per acre. The increase in yield, then, was 3.1 bu. with an increase in rainfall of 0.15 in. By the use of a correlation table it can be easily shown that an increase of 0.15 in. in rainfall could not be expected to increase the yield more than 0.1 bu. per acre. The rest of the increase, 3 bu. per acre, is therefore probably due to better farming methods."

The weather and climate of Salt Lake City, Utah, A. H. THIESSEN (*Proc. Pan Amer. Sci. Cong., 1915-16*, vol. 2, pp. 203-225, figs. 17).—This paper shows not only the averages but the extremes and variations from the normal of the principal meteorological elements as recorded at Salt Lake City since 1875. The data show an equable climate which is ascribed to the fact that very few clouds pass directly over the city and that the city is in a sheltered position from the mountains.

The climate of Cuba, M. GUTIÉRREZ-LANZA (*Proc. 2. Pan Amer. Sci. Cong., 1915-16*, vol. 2, pp. 132-172, figs. 11).—The available climatic data for Cuba are carefully reviewed in this article (in the Spanish language).

SOILS—FERTILIZERS.

Soil moisture studies under dry farming, F. S. HARRIS and J. W. JONES (*Utah Sta. Bul. 158 (1917)*, pp. 51, figs. 33).—This bulletin reports the results of experimental work conducted in cooperation with the U. S. Department of Agriculture at the Nephi substation, involving rather extensive soil moisture studies on a deep alluvial reddish-brown clayey to sandy loam, for the period of 1908 to 1916, inclusive. Meteorological data, presented in tables, show the average precipitation for the period 1898 to 1916, inclusive, to have been 13.48 in., about 85 per cent of which fell during the nongrowing season between October and May. The average evaporation from a free-water surface during April to October, inclusive, for the period of 1908 to 1916, amounted to 45.6 in. The average wind velocity for the summer months approximated 4.5 miles per hour, while the temperature seldom reached 100° F. The plats were sampled in 1-ft. sections to a depth of 6 ft., with a soil tube in the spring, summer, and fall, with the exception of one series of plats sampled to a depth of 10 ft.

The experimental work herein reported embraced a comparison of numerous land practices deemed especially valuable in the accumulation and utilization of soil moisture under conditions prevailing at the substation, and is described under the general headings of stubble treatment, plowing, cultivation of fallow, summer crops, manure, and storage and use of water by winter wheat in 1915 and 1916.

The results are discussed in considerable detail, illustrated by diagrams and summarized as follows:

"Disking stubble before fall plowing or after harvest before spring plowing was not beneficial in moisture storage. Burning stubble before fall plowing slightly increased the moisture content of fallow.

"More moisture was held in the upper 6 ft. of spring-plowed than of fall-plowed fallow. In years of high precipitation, moisture was stored to a depth of 7 ft. in summer fallow, while in dry years it accumulated only to a depth of 3 or 4 ft. Plowing both in the fall and in the spring did not store more moisture than either spring or fall plowing alone. Practically the same amount of moisture was found in land plowed shallow, deep, and subsoiled.

"Cultivation of fall-plowed fallow by eradicating weeds and volunteer grain conserved a great deal of moisture, but the cultivation of spring-plowed fallow was of doubtful value.

"Mulched fallow retained only slightly more moisture than fallow on which the weeds were killed with a sharp hoe but not mulched; hence, destroying weeds is more important than maintaining a mulch in conserving moisture in fallow land. Straw mulches were more efficient in preventing evaporation than soil mulches. Deep mulching was more effective in retaining moisture in spring-plowed fallow than in fall-plowed fallow. Fallow soil lost from 0.7 to 2 per cent in addition to the rainfall between spring and fall of the fallow summer.

"Continuously cropping to winter wheat did not deplete the moisture supply to a depth of 10 ft. more thoroughly than alternate cropping. Although the intertilled crops—corn, peas, and potatoes—used moisture to a depth of 5 ft., they did not dry the soil so thoroughly nor so deeply as did winter wheat.

"Manure, especially when as much as 20 tons to the acre was added, increased the water-holding capacity of cropped soil and slightly increased that of the second foot in fallow.

"Winter wheat used moisture to a depth of 6 ft. Stubble and fall-plowed soils gained considerable moisture to a depth of 6 ft. between the fall of 1915 and spring of 1916. Moisture penetrated deeper and more quickly in new than in dry soil. Summer tillage aided materially in conserving soil moisture.

"At Nephi about 18 in. of water can be stored in the upper 6 ft. of soil. Indications are that crops extend their roots into the lower soil layers for water, but that little moisture is raised from great depths by capillarity in this soil. It required from 0.5 to 1 in. of rain in the fall to connect the dry surface soil on fallow with the moist soil below.

"The minimum point to which winter wheat used water from the soil was about 10 per cent. Hence, water above 10 per cent is available for this crop.

"From 54 to 65 per cent of the precipitation falling between September 20 one year and the following September was found in the upper 6 ft. of soil. Fallow land at Nephi averaged 17.5 per cent water in the upper 6 ft. of soil in the fall. At seeding time about 6.4 in. of this moisture was available for plants. During the winter after the fallow there is usually about 4 per cent, or 3.5 in., of available moisture stored. Probably never more than 10 in. of water in the upper 6 ft. of this soil is available for plant use. Even in the best years following a fallow considerably less than one year's precipitation was available for crops in the first 6 ft. of the soil."

Soil moisture studies under irrigation, F. S. HARRIS and A. F. BRACKEN (Utah Sta. Bul. 159 (1917), pp. 26, figs. 19).—This bulletin reports the results of several thousand moisture determinations of cropped and uncropped fall soils during a number of years under irrigation, in a study of some of the problems of soil moisture movement and distribution under field conditions, including experiments with potatoes and beets under irrigation, observations of moisture conditions in furrow irrigation and after flooding, the effect of mulches in conserving moisture, a comparison of cropped and fallow soils, and the effect of manure. The work was conducted on a deep, rich clay loam, dark in color

and uniform in texture to a depth of at least 10 ft. and containing approximately 40 per cent calcium and magnesium carbonates. Various amounts of irrigation water were used, and 1-ft. sections of soil taken to a depth of 10 ft. were collected at different intervals of time before and after the irrigation treatments. The results are discussed in some detail and pictured diagrammatically, and may be briefly summarized as follows:

A marked similarity was apparent in the content and distribution of moisture in soils producing potatoes and sugar beets. The efficiency of the water decreased with the amount applied, 1-in. weekly applications showing a greater increase in moisture to a depth of 10 ft. in proportion to the amount applied than either 2.5, 5, or 7.5 in. weekly and also gave a higher crop yield.

The initial percentage of moisture in the soil influenced the distribution of the irrigation water applied. Furrow irrigation was found to be more effective in conserving moisture than flooding. The lateral movement of soil moisture after irrigation was slow, particularly in the upper feet.

A straw mulch proved to be more effective in moisture conservation than an earth mulch, and the latter more effective than no mulch with the weeds pulled, although after the eighth day the differences were so small that the advisability of weeding hinged on the question of labor. When no irrigation water was applied the soil retained as much moisture where the weeds were pulled as where the soil was cultivated.

The crop was able to reduce the soil moisture to a depth of 10 ft., the difference in the moisture content of cropped and uncropped soil decreasing with an increase in the amount of irrigation.

Manure had very little effect upon the distribution of moisture in the soil.

It is concluded that the application of more irrigation water than is actually required to satisfy the needs of the crop is a wasteful practice.

The rate of water movement in aerated soils. H. E. PULLING (*Soil Sci.*, 4 (1917), No. 5, pp. 239-268, figs. 13).—Osmometer experiments conducted at the University of Wisconsin on nontoxic, nonsaline black sandy loam garden soil and sandy soil are reported and discussed. A form of osmometer specially adapted to the study of mass or molar movement of the soil water is described and its methods of use are explained in detail, as are the reducing and plotting in form of graphs of the data obtained.

A list of 22 references to literature on the subject is given.

The shrinkage of soils. H. A. TEMPANY (*Jour. Agr. Sci. [England]*, 8 (1917), Vol. 8, pp. 312-330, figs. 4).—Experiments are reported in which by determination of the internal pore space in blocks of soils and comparison with the observed value for the linear shrinkage it was found that a linear relationship appeared to exist between the two values. This relation is expressed by the equation

$$C = \left(3a - \frac{3a^2}{10^2} + \frac{a^3}{10^4} \right),$$

in which C = the percentage of cubical contraction and a the percentage of linear contraction.

By extrapolating the curve thus obtained an approximation for the limiting value of the shrinkage in the case of pure colloidal clay was arrived at amounting to approximately 23 per cent. On this assumption it was possible to calculate the approximate content of colloidal material in any soil from a knowledge of the linear shrinkage. Results are adduced showing the values obtained for the shrinkage in the case of separated fine silt and clay fractions in the case of two soils of known shrinkage and physical composition and compared with the values calculated from previous assumptions. The results of the calcula-

tion of the content of colloidal clay in the foregoing manner in the case of 18 Leeward Islands soils are appended.

The proof of microbial agency in the chemical transformation of soil, H. J. CONN (*Science, n. ser., 46 (1917), No. 1185, pp. 252-255*).—The author is of the opinion that "to show conclusively the agency of any microorganism in any chemical transformation occurring in soil, the following steps are necessary: (1) The organism must be shown to be present in active form when the chemical transformation under investigation is taking place, (2) it must be shown to occur in larger numbers under such conditions than in the same soil in which the chemical change is not occurring, (3) it must be isolated from the soil and studied in pure culture, and (4) the same chemical change must be produced by the organism in experimentally inoculated soil, making the test, if possible, in unsterilized soil."

[**Soil bacteriology**], C. M. HUTCHINSON (*Ann. Rpt. Bd. Sci. Advice India, 1915-16, pp. 114-116*).—In studies of soil toxins and nitrification "a series of field experimental plats under wheat demonstrated the production of infertility in soil containing nitrogenous organic matter (oil cake) as a consequence of semianaerobic conditions artificially induced by water-logging. This infertility did not occur to the same extent when ammonium sulphate was substituted for cake, nor did the effect of the water-logging become apparent until the roots of the plants had gone down some inches, to that level in the soil which oxidation consequent on the cultivation had failed to reach. Parallel plats with barley illustrated this effect more markedly than those with wheat. . . . Laboratory work on nitrification and on the growth of seedlings in water and soil cultures demonstrated the possibility of separating substances from certain bacterial cultures, from decomposing organic matter, and from anaerobically incubated soil whose toxicity to nitrifiers, and in greater concentration to seedling plants, was demonstrable under these conditions.

"Observations were made as to the interference with the growth of seedlings resulting from the bacterial invasion of the unexhausted and still attached seed and the consequent absorption by the plant of toxic bacterial by-products. This invasion occurred most readily in water-logged soil and more especially in the presence of the bacteria derived from anaerobically incubated soils of high organic matter content. Copper sulphate was found to neutralize most of the toxic bodies obtained in this way, and seeds treated with this salt were found to be immunized to some extent, although not entirely or invariably, against this action."

The influence of arsenic on the bacterial activities of a soil, J. E. GREAVES (*Sci. Mo., 5 (1917), No. 3, pp. 204-209*).—This is a review of work on the subject at the Utah Experiment Station, it being pointed out that arsenic by various means stimulates the bacterial activities of soil, which results in greater crop yields. "This increased growth must be looked upon as due to a stimulant and not to the direct nutritive value of the substance added, and soils so treated would wear out more quickly and produce larger crops than would soils not so treated. It is . . . important to know that arsenic has to be applied to a soil in enormous quantities before it retards microscopic plant life, and most likely before it retards the growth of higher plants." "Other experiments have demonstrated that the addition of arsenic to a soil causes the liberation of the insoluble plant foods of the soil, especially the phosphorus.

The effects of alkali salts on nitrification, P. E. BROWN and E. B. HITCHCOCK (*Soil Sci., 4 (1917), No. 3, pp. 207-229, figs. 14*).—Experiments conducted at the Iowa Experiment Station to determine the concentration at which various alkali salts become toxic to nitrifying bacteria in alkali soil and in normal soil are reported.

It was found that "nitrification in normal soil is stimulated by small amounts of sodium chlorid, sodium sulphate, and magnesium sulphate, and large amounts of calcium carbonate. These salts become toxic, however, at certain points, which undoubtedly vary in different soils. With this soil in laboratory tests the toxic point was 0.02 per cent sodium chlorid, 2 per cent sodium sulphate, and between 1.5 to 6 per cent calcium carbonate. The toxic point for magnesium sulphate was not determined. Nitrification in alkali soil was increased by small amounts of sodium bicarbonate, sodium carbonate, and calcium carbonate. Calcium sulphate had no effect. These salts became toxic in this soil at 0.3 per cent for both the sodium carbonate and bicarbonate and at 6 per cent for the calcium carbonate. The addition of calcium sulphate with the sodium carbonate and bicarbonate, in the proper amount to react with them, prevented any toxic effect from the largest amount used.

The tests in the greenhouse soils checked very closely with the laboratory studies in the case of the alkali soils. In the normal soils the agreement was likewise good, except in the case of sodium sulphate. That salt became toxic according to these tests at a concentration of 0.5 per cent. This is a very much lower toxic point than was noted above but nearer that found by others. The effects on the crop grown in normal soil of the alkali salts, with the exception of the sodium sulphate, were very similar to the effects on nitrification in both laboratory and greenhouse tests. Increases were secured with sodium chlorid, magnesium sulphate, and calcium carbonate, but sodium sulphate caused a depression in crop and in nitrification in the greenhouse soils. All the salts together had no effect. In general, it seems that nitrification and crops are very similarly affected by alkali salts.

Crops refused to grow in the alkali soil, but the injurious factor was evidently not an excess of sodium bicarbonate or carbonate, as additions of these salts increased nitrification in the soil. The injurious factor was likewise evidently not calcium carbonate, for that compound stimulated nitrification in the alkali soil."

Reclaiming niter soil in the Grand Valley, E. P. SANDSTEN (*Colorado Sta. Bul. 235 (1917), pp. 3-8, figs. 4*).—Field tests of methods for the correction and reclamation of abandoned niter land in the orchard areas of the Grand Valley of Colorado led to the conclusion that flooding gave the quickest results, especially on well-drained lands. While the corrugating system of irrigation (letting water run for 36 hours in furrows made close together after seeding the land) appeared adequate for soils in the first stages of niter poisoning, it was found to be slower and in the long run more expensive than flooding on land made unproductive by excessive niter. The results emphasize especially the necessity for good drainage in reclaiming niter soils.

It was also found that cover crops alternating with clean culture tended to check niter poisoning in bearing orchards.

Soil survey of Harnett County, N. C., R. C. JUNEY and S. O. PERKINS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 380,800 acres in the east-central part of North Carolina, lying mainly in the Coastal Plain but with part of the north-western section of the county in the Piedmont. The topography of the county varies from flat and gently undulating to rolling, hilly, and broken. The area is well drained with the exception of the flatwoods section and some of the first bottom lands.

The soils of the county are derived from unconsolidated sands and clays of sedimentary origin in the Coastal Plain section and from igneous and

metamorphic rocks, chiefly mica schist, gneiss, granite, and slate in the Piedmont Plateau section. Twenty-four soil types of 13 series are mapped in addition to swamp, gravel hills, and rock outcrop. Norfolk sand and Norfolk sandy loam predominate, occupying 26.2 and 19.4 per cent of the area of the county, respectively.

Reconnaissance soil survey of south part of north-central Wisconsin. W. J. GEIB, A. E. TAYLOR, J. B. R. DICKEY, C. THOMPSON, T. J. DUNNEWALD, and C. E. POST (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 65, pls. 4, figs. 2, map 1*).—This survey, made in cooperation with the State of Wisconsin, deals with the soils of an area of approximately 2,985,600 acres in the south part of north-central Wisconsin, comprising Taylor, Lincoln, Clark, and Marathon Counties. A general report and map of this area has already been noted (*E. S. R., 16, p. 27*).

The topography of the northern and eastern parts of the area ranges from level to rough and broken, while over the remainder of the area the slopes are long and gentle and there are few lakes and swamps. The soils of the area are of glacial origin, although the periods of glaciation which influenced the regions were separated by long periods of time. Twenty-four soil types of 8 series are mapped in addition to areas of peat and rough, stony land, Spencer silt loam and Gloucester silt loam occupying 44.8 and 14.3 per cent of the area, respectively, predominating.

The composition of the soils of south-central Texas. G. S. FRAPS (*Texas Sta. Bul. 213 (1917), pp. 48*).—This bulletin reports chemical analyses of samples of soil from an area comprising 19 counties in south-central Texas, previously described and mapped by the U. S. Department of Agriculture (*E. S. R., 34, p. 213*). Analyses of the surface and subsoils of the various soil types found in the area are tabulated in a comparison of the soils by counties. An interpretation of the analyses with reference to plant food deficiencies is given.

"Black alkali" in the San Luis Valley. W. P. HEADDEN (*Colorado Sta. Bul. 231 (1917), pp. 3-15*).—Reviewing certain factors thought to be largely responsible for the almost complete loss of fertility of an area of from 400,000 to 500,000 acres in the San Luis Valley of Colorado, and based upon his own observations, the author concludes that so-called black alkali, composed largely of sodium carbonate, is the primary cause of the barren soils. The waters of the valley, including the rivers and artesian wells, are carriers of the carbonate, and the practice of subirrigation has brought the alkali to the surface by capillarity and evaporation. The presence of white alkali, mostly sodium sulphate, even in large quantities, and of nitrates, although the latter are sometimes present in sufficient quantities to inhibit growth, are deemed of secondary importance as compared with the black alkali. The maintenance of a high-water plane (22 to 12 in. from the surface), due to subirrigation, as a contributing factor to low production, is also thought to be relatively unimportant, since good crops are produced by subirrigation in other regions. By actual analyses the soils of the valley were found to be fairly well supplied with the more essential plant food elements.

It is suggested that the remedy lies in a conversion of the carbonates into sulphates by the use of a sufficient amount of gypsum, for all practical purposes about 9 lbs. of gypsum to 1 lb. of black alkali, and downward washing by means of surface irrigation with furrows or by flooding. While some drainage is deemed necessary to reclaim parts of this area, it is still regarded as an open question as to the benefits to be expected from large systems aiming to drain the whole section.

[Progress report of soil and fertilizer work in Rhode Island], B. L. HARR-
WELL (*Bul. R. I. State Col.*, 12 (1917), No. 4, pp. 18-23).—This briefly reviews
the progress during 1916 of investigations relating to vegetable matter for the
soil, the efficiency of manures, the neutralization of sour soils, and specific plant
differences and needs.

Food from the air, H. LEFFMANN (*Trans. Wagner Free Inst. Sci. Phila.*, 8
(1917), pp. 1-14, figs. 4).—This is a description of the processes of fixation of
atmospheric nitrogen by oxidation, by absorption, and as ammonia. A biblio-
graphy of recent literature on the subject is appended.

The fixation of nitrogen in feces, E. H. RICHARDS (*Jour. Agr. Sci. [England]*,
8 (1917), No. 3, pp. 299-311, figs. 2).—Experiments conducted at the Rothamsted
Experiment Station with horse and cow manure are reported.

It was found that "horse feces contain material capable of fixing nitrogen
when fermented aerobically in presence of sufficient moisture and calcium car-
bonate. This fixation is a function of the diet, for when horses are fed on
grass alone instead of corn and hay the amount of nitrogen fixed is much re-
duced. Under the most favorable conditions 1 gm. of dry matter in the feces
will fix 4 mg. of nitrogen. Bullock feces will also fix nitrogen but to a much
smaller extent than horse feces. This is also a function of the diet as it only
occurs when the animals are fed with cake. On grass alone no nitrogen is fixed.

"The organisms concerned in the fixation of nitrogen are present in garden
soil. Evidence is adduced to show that fixation is brought about by a mixed
culture of *Azotobacter* and *Bacillus lactis arogeus*. Of these the latter is
normally present in feces; *Azotobacter* is not, but readily infects feces. Both
organisms are present in the soil used and will fix nitrogen in raw feces but
not in sterile feces."

The availability of phosphoric acid in rock phosphate, G. S. FRAPS (*Texas
Sta. Bul.* 212 (1917), pp. 40).—The results of numerous pot experiments to de-
termine the percentage of added phosphoric acid recovered in the crops grown
upon a soil are reported in detail and previous investigations by the author on
the subject are reviewed (*E. S. R.*, 23, p. 423; 34, p. 421.) Detailed data are
given for recovery of phosphoric acid by crops from acid phosphate and rock
phosphate and the effect of manure upon the recovery.

"The average recovery of phosphoric acid on 25 pot experiments for several
crops is 48.2 ± 2.2 per cent. The average recovery in 22 experiments for the first
crop is 30.6, compared with 47.3 per cent for all the crops. The average quan-
tity of phosphoric acid removed from manure in 22 experiments is 39.2 per cent,
compared with 37.9 for acid phosphate in the same series. The manure has
probably made some phosphoric acid of the soil available. The average re-
covery from acid phosphate when used with manure is less than for the acid
phosphate used alone, perhaps due to the supply exceeding the needs of the
plants in some of the tests. The average recovery of phosphoric acid from rock
phosphate in 21 experiments is 9.1 ± 1.1 , compared with 43.9 ± 2.3 for acid phos-
phate in the same experiment. Thus the phosphoric acid in rock phosphate had
about one-fifth the availability of that in acid phosphate in these tests, in which
several crops were grown.

"There are very decided variations in the value of rock phosphate in differ-
ent soils. If the first crops grown are considered, and no others, phosphoric
acid of acid phosphate has about six times the availability of that in rock phos-
phate. In 19 pot experiments the recovery of phosphoric acid from rock phos-
phate alone was 9.6 ± 1.3 per cent, and for rock phosphate with manure it was
 8.6 ± 1.2 per cent after correction for the phosphoric acid removed from the ma-

nure alone. The manure had no effect upon the assimilation of phosphoric acid from rock phosphate in these experiments."

Acid phosphate v. raw phosphate rock. C. E. THORNTON (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 11, pp. 350-356, figs. 3).—Reviewing the results of fertilizer experiments at Strongsville (E. S. R., 36, p. 820) during the past 13 years, in a comparison of the effects of raw rock phosphate and acid phosphate used alone and in combination with lime and other fertilizing materials upon the wheat crop in a rotation of corn, oats, wheat, clover, and timothy, it was found that the 5,000 lbs. of rock phosphate used during the 13 years returned more than three times its cost in increased yields, and that the 900 lbs. of acid phosphate used returned more than ten times its cost. It was concluded, therefore, that "it is not a question whether rock phosphate may be used with profit, but merely one of relative profit."

Reactions of the phosphorus of the thickened root of the flat turnip. B. L. HARTWELL, F. S. HAMMETT, and P. H. WESSELS (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 8, pp. 359-370).—Previous investigations at the Rhode Island Experiment Station (E. S. R., 29, p. 417) have shown that the percentage of total phosphorus in flat turnip roots (*Brassica rapa*) grown in different soils generally varied in the same direction as variations in the amount of phosphorus available to the plant. Further investigations were undertaken to ascertain whether the amount of any portion of the phosphorus of the turnip root might be more nearly correlated than total phosphorus with the relative amount available in soils.

Preliminary studies indicated that larger amounts of phosphorus could be extracted from fresh than from dried material. Microchemical examinations of turnip roots grown in culture solutions with and without phosphorus and chemical examinations of turnip extracts are discussed, together with results of dialysis of the extracts. The results are summarized as follows: "Coincident with the introduction of phosphorus into a nutrient solution in which turnips were growing, the appearance of 'inorganic' phosphorus and the disappearance of starch were traced microscopically in the different tissues; whereas upon withholding phosphorus the disappearance of inorganic phosphorus and the appearance of starch were similarly observed. About four-fifths of the total phosphorus of fresh turnips was extracted with water. When the latter was acidulated, somewhat less was secured because of partial precipitation.

"Only a few per cent of the extracted phosphorus failed to pass through dialyzers. Different precipitants of inorganic phosphorus were tested as to their ability to recover phosphate added in a standard solution to the dialyzates. The phosphorus in the precipitate formed by adding acetic acid to turnip juice was not in phosphoprotein compounds. There was no phytin in the juice. The presence of a phosphatase was not shown.

"Although the proportion of inorganic to total phosphorus in turnips was frequently made larger by phosphatic applications to the soil in which they were grown, this was not always shown to be the case by such methods as were used. In most instances the phosphorus in the juice was so largely inorganic and constituted so large a proportion of the total that the determination of the latter seemed about as useful as of any portion for furnishing indications regarding the relative amount of soil phosphorus at the disposal of the turnip."

A list of references to literature on the subject is given.

Potash in 1916. H. S. GALE (*U. S. Geol. Survey, Min. Resources U. S.*, 1916, pt. 2, pp. V+13-171, figs. 2).—This report, dealing with the production of potash in 1916 and developments and projects therefor in the United States, states that "the manufacturers of potash salts and potash products in the United

States reported a production in 1916 of 35,739 short tons, having a mean content of about 27 per cent potash (K_2O) and a total content of 9,720 short tons of potash (K_2O). This is almost exactly ten times the production reported for 1915." The reports for all forms are reduced to tons of available potash in the following table:

Summary of potash produced in 1916.

Source.	Available potash (K_2O).	
	Quantity.	Value at point of shipment.
Natural salts or brines.....	Short tons.	
Alunite and silicate rocks, including recoveries through furnace dust.....	3,994	\$1,937,000
Kelp.....	1,850	715,000
Wood ashes (potashes, pearlash).....	1,556	781,100
Distillery waste (molasses).....	412	270,000
Miscellaneous organic sources.....	1,845	500,900
	63	38,130
	9,720	4,242,730

"The largest output has come from the alkali lakes in western Nebraska, which have afforded the most readily available supply of moderately high-grade potash salts obtained by direct drying of the raw material, with perhaps as few technical complications as could be involved in any chemical operation. The great deposit at Searles Lake is only just being brought to the producing stage, the project there having undergone many reverses, technical and otherwise. The production from alunite has been rather regular, but has shown little expansion. Some progress has been made in the extraction of potash from silicates, at least one plant having made and marketed a special product. A large quantity of feldspar has been mined, ground, and so treated that a small percentage of its potash was rendered soluble and so available for use in fertilizers, but none of it is included in the figures for 1916, as little of it was marketed in that year. So far as known, no leucite rocks or mica or sericite schists or similar rocks having a large content of potash have yet yielded any commercial water-soluble salts.

"Potash has been produced from several kinds of organic materials. The efforts to obtain potash and potash fertilizers from kelp have been widely published and have been to a certain extent successful. High-grade potash fertilizer salts have been made from molasses distillery wastes in quantities that exceeded the production from kelp. The manufacture of potash from wood ashes by the old-time methods continues to make a small but significant contribution to the total production."

The divergent effects of lime and magnesia upon the conservation of soil sulphur, W. H. MACINTIRE, L. G. WILLIS, and W. A. HOLDING (*Soil Sci.*, 4 (1917), No. 3, pp. 231-237, figs. 2).—Experiments at the Tennessee Experiment Station with a mellow sandy loam soil are reported, in which burnt lime, burnt magnesia, precipitated calcium carbonate, precipitated magnesium carbonate, 100-mesh limestone, 100-mesh dolomite, and 100-mesh magnesite were added to the soil at rates equivalent to 8, 32, and 100 tons of calcium oxid per acre. Each treatment was thoroughly mixed with moist soil in good, workable condition and placed in a galvanized iron lysimeter containing a sand filter bed and having a block tin drainage tube. In a second set, placed simultaneously, the foregoing treatments were duplicated as to surface soil, but 1 ft. of clay sub-soil was placed between each sand filter and the overlying surface soil.

During the first year the loss of sulphur was very much heavier from the tanks containing only surface soil than from the tanks which contained subsoil also. As a rule the same held for the second year except where the oxid and precipitated carbonate of magnesium were applied. The averages of the total amounts of SO_4 leached from all the tanks receiving the several carbonates were 472 lbs. and 221 lbs. per acre, respectively, for the years 1914-15 and 1915-16, in the case of the tanks having no subsoil, as compared with 31.1 lbs. and 114.8 lbs. per acre, respectively, for the identically treated tanks during the same two years where the surface soil was underlaid with 1 ft. of clay subsoil. Analyses of the leachings established the fact that the downward movement of sulphur and that of magnesium were parallel.

The 8-ton applications of burnt lime slightly depressed the amounts of sulphur coming through in the leachings, as compared with the other and equivalent treatments, while the 32-ton and 100-ton treatments practically inhibited the outward movement of sulphur in solution. No such retardation in the sulphate leachings was demonstrated by the precipitated carbonate or by the natural carbonate of lime, even in the case of the 100-ton equivalent applications. During the second year, when the 32-ton treatment of lime had become in large part carbonated, the increase in the sulphates leached was over sixfold. The effect of oxid of magnesium was the reverse of that produced by burnt lime. All of the natural carbonates in the several amounts appeared to bring about conditions which caused an augmented outgo of SO_4 when compared with subsoil tanks which received no carbonate treatment.

See a previous note related to the subject (E. S. R., 31, p. 815).

Accessory factors for plant growth, O. ROSENHEIM (*Biochem. Jour.*, 11 (1917), No. 1, pp. 7-10, pl. 1).—Experiments with water extract of bacterized peat are reported. The results are taken to indicate that the action of the extracts on plant growth demonstrated the presence of substances similar to the vitamins in their general behavior.

Analysis of fertilizers for 1917, B. E. CURRY and T. O. SMITH (*New Hampshire Sta. Bul.* 185 (1917), pp. 11).—This bulletin reports the guaranteed and actual analyses of 165 official samples of commercial fertilizers and fertilizing materials collected and analyzed in 1917.

Commercial fertilizers in 1916-17, G. S. FRAPS (*Texas Sta. Bul.* 217 (1917), pp. 26).—This bulletin reports the guaranteed and actual analyses of commercial fertilizers and fertilizing materials for the season of 1916-17, together with a list of the brands registered for sale during the season.

It is stated that the results of numerous chemical analyses, pot tests, and field experiments on Texas soils make it "evident that Texas farmers can well afford to eliminate potash from general fertilizers, especially for cotton and corn. . . . In the majority of cases potash is not needed, being supplied by the soil in sufficient quantity. . . . Texas soils can get on much better without any addition of potash than without phosphoric acid or nitrogen. . . . The present prices of potash are much too high to warrant its use as a fertilizer."

AGRICULTURAL BOTANY.

The methods and value of cytology, A. GUILLIERMOND (*Rev. Gén. Sci.*, 23 (1917), Nos. 6 pp. 166-174, figs. 7; 7, pp. 208-216, figs. 9).—A discussion is given of the various fixation methods and of their values, which are compared respectively with the methods of study of the living cell and with the particular or relative values of such studies. Some of the author's investigations on the relation between the appearance and activities of mitochondria and their

functions as related to such substances as starch, oils, and coloring matters are also discussed.

A study of the fixation of the cytoplasm. A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 17, pp. 643-647).—The author describes a method which is claimed to produce as nearly perfect fixation of cytoplasm as is possible to obtain. He states that in a drop of 3 per cent acetic acid the mitochondria of epidermal cells of Tulip immediately assume a vesicular appearance, while in one of 5 per cent strength the chondriome is almost entirely dissolved at once. The mitochondria appear to be the least resistant of the cellular elements, the most difficult of fixation, and particularly subject to injury in osmotic changes.

The presence of lipoids in Nicotiana as related to starch and nicotin. A. PARROZZANI (*Rend. e Mem. R. Accad. Sci., Let. ed Arti Zanetti Accirale*, 3. ser., 7-8 (1912-1915), pp. 35-56).—A study of lipoids in young and in adult plants of several species of *Nicotiana* is said to support the findings of Buscalloni (E. S. R., 31, p. 427) in this respect, lipoids being often found in the chloroplasts of the leaves of adult plants and being more abundant in the older basal leaves than in those toward the apical regions, as also in the lower portions of the stems. Lipoids are almost lacking in very young plants. Starch occurs in a way somewhat paralleling the occurrence of lipoids as regards the stems and the age of the plants, but it disappears from the marginal and some other portions which, in leaves higher up, show a quantity greater than is usual. Details are given of the relative abundance of these and other substances in the various portions of the plant at different ages.

Carbon [assimilation] in green plants. G. POLLACCI (*Atti Ist. Bot. R. Univ. Padov.*, 2. ser., 17 (1917), pp. 29-51, figs. 2).—The studies previously noted (E. S. R., 29, p. 28; 35, p. 435) having been continued with different plants, the author observed an increase of weight in those from which atmospheric air was excluded with the exception of the roots. It is concluded from this that the roots of such plants are able to appropriate carbon dioxide from the atmosphere and utilize it in their development.

Report of the bacteriologist. M. MULVANIA (*Tennessee Sta. Rpt.*, 1913, pp. 159-161).—This is a brief progress report on studies of the ability of bacteria to produce humus from definite forms of organic matter, such as cottonseed meal, ground straw, and cow dung, and of the influence of humus on nitrogen-assimilating bacteria (*Azotobacter*), employing certain modifications of methods previously described (E. S. R., 28, p. 727).

Humification was found to proceed in direct proportion to the amount of organic matter present, but the sterilized flasks always gave as much humus as those inoculated with bacteria and often more. Sterilization slightly decreased the extractable matter. There was a decided loss of nitrogen from the inoculated flasks. It was concluded that "under the conditions maintained organic matter in the inoculated flasks is decomposed, nitrogen is liberated, but humus is not produced."

Present methods are not deemed adequate for a study of the effect of humus upon nitrogen assimilation by *Azotobacter*. The associative action of *Azotobacter*, *Bacillus radicicola*, and *B. subtilis* in nitrogen fixation was observed to add more nitrogen to the mannite solution than when these microorganisms worked in any other combination.

The influence of water and of mineral matters on the development of plant-lets. L. MAQUENNE and E. DEMOUSSY (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 26, pp. 979-985).—The lowering of the growth rate of pea seedlings when sprouted in the purest water obtainable is thought to result from the absence of the very minute quantities of material commonly dissolved out of

the containers, more particularly while the water is warm, calcium being apparently the sole or chief constituent which is influential in this connection.

The influence of calcium salts on absorbing root hairs. H. COUPIN (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 17, pp. 641-643).—*Lepidium sativum* was exposed, after germination in tap water, to varying solutions of calcium sulphate, carbonate, nitrate, or chlorid. It was found that the growth of the root hairs was inhibited by the last three of these calcium compounds.

The use of perphosphates in agriculture. N. A. BARBIERI (*Gaz. Chim. Ital.*, 47 (1917), I, No. 1, pp. 38-51).—It is stated that all the phosphorus contained in animals or plants is in the form of soluble or insoluble phosphates. Plants do not yield nor will they absorb monocalcium or dicalcium phosphate, these substances arresting germination of the seed or development of the plant. Cereals or legumes from soils furnished with perphosphates contain less total phosphorus than do those from neighboring soils lacking perphosphates. Perphosphates may kill seeds with which they come into direct contact.

Studies in greenhouse fumigation with hydrocyanic acid: Physiological effects on the plant. W. MOORE and J. J. WILLAMAN (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 7, pp. 319-338, pl. 1, figs. 11).—In continuation of investigations previously reported (*E. S. R.*, 38, p. 158), the authors have conducted a study to determine the action of hydrocyanic acid gas on the tissues of the plant. All of the investigations have been conducted at the Minnesota Experiment Station.

It has been found that plants subjected to hydrocyanic acid fumigation absorb more or less of the gas, the immediate effect of the poison being a reduction in the activity of the oxidases and catalase and hence in respiratory activity. Following this action, there is an inhibition of photosynthesis and translocation of carbohydrate and a closing of the stomata. The permeability of the leaf septa is said to be increased and this causes less rapid intake of water from the stems and more rapid cuticular transpiration. In mild cases this may result in merely a temporary wilting, while in more severe fumigations the wilting is followed by disintegration and death of the tissues. The authors claim that the primary effect of the presence of hydrocyanic acid in a plant is a disturbance of the oxidase and catalase activities, all other physiological effects being secondary to this.

The physical control of vegetation in rain-forest and desert mountains. F. SHREVE (*Plant World*, 20 (1917), No. 5, pp. 135-141).—The purpose of this paper is to bring out some of the contrasts between the manner of control of vegetation by conditions in the humid mountains of a tropical island and that in the arid mountains of a temperate continental region. The basal details are to be found in the author's publications previously noted (*E. S. R.*, 32, p. 748; 34, p. 27).

Calling attention to instances illustrating the fact that two mountain ranges may differ greatly in flora while having practically identical controlling environmental factors, the author shows that the actual factors which underlie the topographic control of the vegetation in the desert mountains of Arizona and those in the Blue Mountains of Jamaica are diametrically opposed.

Critical flowering and fruiting temperatures for *Phytolacca decandra*. F. E. LLOYD (*Plant World*, 20 (1917), No. 4, pp. 121-126).—The author has made observations on pokeweed in two diverse climates widely different from that of its native habitat for several years, during which time it produced seed only under certain exceptionally favorable circumstances at Carmel, Cal. He concludes that if the prevailing day temperatures, which are normally low enough to prevent reproduction by the seed, were 5° warmer during the warmest hours

of the day, the species would be able to perpetuate itself in this locality by means of seed.

Modifications produced by sea winds in the male inflorescences of pine. J. DUBÉNOY (*Compt. Rend. Soc. Biol. [Paris]*, 80 (1917), No. 4, pp. 174, 175).—The author notes the occurrence, in pines exposed to sea winds, of a curving of the male inflorescence with other alterations which are detailed, also of other modifications apparently supporting the view that ecological conditions may cause the development of rudimentary branches into structures which may be reproductive, assimilative, or multiplicative in their functions.

The bacteriological study of natural coagulation in latex of *Hevea brasiliensis*. DENIER and G. VERNET (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 3, pp. 123-126).—Hevea latex, which has when first collected a milk-white color and corpuscles showing the Brownian motion, is at that time almost free from bacteria. These, however, soon develop abundantly. The author noted the presence of organisms, both aerobic and anaerobic, in latex. One is described in some detail as to its characters and influence on coagulation, which it is said to accomplish in 24 hours. Suggestions are given regarding conditions favorable to the coagulation of latex.

Sexuality in *Myxomycetes*. F. X. SKUPIENSKI (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 3, pp. 118-121).—The author describes observations claimed to show that a marked sexuality exists in *Didymium nigripes*.

Parthenogenesis in higher plants. A. C. HAGEDOORN-LA BRAND and A. L. HAGEDOORN (*Teymannia*, 27 (1917), No. 11-12, pp. 643-656, pl. 1).—An account is given of the crossing of cucurbits said to have been produced from seed without pollination with those from hybrid plants. The results, though vitiated in some degree by failure ascribed to external causes, suggest some noted by Hering (*E. S. R.*, 32, p. 520; 33, p. 644). It is recommended that in cases where exceptional results are obtained in the progeny of hybrids, investigations be carried out to determine how far partial parthenogenesis or partial apogamy in the ancestors may be responsible for the anomaly.

Quadruple hybrids in the F_1 generation from *Oenothera nutans* and *O. pycnocarpa*, with the F_2 generations, and back crosses and intercrosses. G. F. ATKINSON (*Genetics*, 2 (1917), No. 3, pp. 213-260, figs. 16).—In continuance of a partial report previously made (*E. S. R.*, 30, p. 730) regarding studies on the results of crosses made with *O. nutans* and subsequent studies on crossings of the descendants of these hybrids, the author states that in the F_1 generation of the cross *O. nutans* × *O. pycnocarpa* four hybrid types appeared which have been named, respectively, *O. hybrida nutella*, *O. hybrida pycnella*, *O. hybrida tortuosa*, and *O. hybrida tortuella*. In the F_2 generation of the reciprocal cross three hybrids have been obtained which appear to be identical with the first three above named, and it is thought that the fourth might appear if the crossings were sufficiently numerous.

O. hybrida nutella is a blend hybrid. *O. hybrida pycnella* and *O. hybrida tortuosa* are selective hybrids and are physiological homozygotes, being fixed in the F_1 generation and, when selfed, repeating in the F_2 and succeeding generations. They are regarded as examples of permanent or stable dominance of factors. *O. hybrida tortuella*, also a selective hybrid, is not fixed in the F_1 . When selfed it dissolves in the F_2 into numerous types, some of which are considered as showing that certain factors are activated in this generation which were subordinate in F_1 .

The production of four hybrid types in the F_1 is considered as an example of multiple dominance. In back crosses there appear five cases of patrocliny with ten cases of splitting into two types and four of splitting into three types. In the intercrosses there are two cases of patrocliny, three of splitting into two,

one of splitting into three, and one of splitting into four types. In the intercrosses and back crosses no new types appear except a dwarf form referred to *Ce. gracilis*. Evidence is summarized which is considered to indicate that the gametes in *Ce. hybrida nutans* and *Ce. hybrida pycnocarpa* are uniform.

Inheritance of a mosaic pericarp pattern color of maize, H. K. HAYES (*Genetics*, 2 (1917), No. 3, pp. 261-281, fig. 1).—The author describes experiments carried out with a mosaic pericarp pattern color in maize, employing the progeny of an ear found in the course of work done with East as previously noted (E. S. R., 25, p. 730), which had on one side seeds with a red pericarp and on the other seeds which were white or had but a narrow red stripe.

The first two years of the experiment showed all degrees of variation from dark, heavily striped ears to ears with colorless pericarp. Later selection experiments gave results showing the usual type of Mendelian inheritance, along with some which are not easily explainable by the hypothesis of the absolute purity of fundamental inheritance factors.

Self-fertilization and selection isolated several types which bred relatively true. The self-red, pattern, and colorless selections appear to be homozygous for these characters, the variegated selection proving to be homozygous for the mosaic character and giving ears ranging from heavy striation of nearly all seeds to striation of only a few seeds.

The relation of the various pericarp characters was studied, and it is suggested that certain combinations produce germinal instability. The conclusion is reached that the factors for self-red, variegated, pattern, and colorless pericarp form a series of multiple allelomorphs.

The hybrid origin of alfalfa, L. TRABUT (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 16, pp. 607-609).—The author offers what is held to be sufficient evidence to show that *Medicago sativa* has arisen by hybridization from the two primitive species *M. falcata* and *M. gcutula*, the last named being synonymous with *M. carulca*, *M. contorta*, and *M. tuncana*.

Origin, introduction, and primitive culture of the potato, W. F. WIGHT (*Proc. Potato Assoc. Amer.*, 3 (1916), pp. 35-49).—The author gives the results of a study of early and recent accounts of the cultivated potato and of his personal search, chiefly in South America, for the original wild form of *Solanum tuberosum*. He also gives considerable information of a related but somewhat miscellaneous character regarding the potato plant.

It is stated that many of the wild species so resemble the cultivated forms (so far as superficial foliage characters are concerned) that persons very familiar with the latter have often been deceived. In every case, however, which the author has fully investigated the plant has proved to be some other species, and after a century and a half of intermittent collecting there is nowhere known to be evidence showing conclusively that the species is now growing indigenously anywhere in its original condition.

It is stated that throughout a large portion of these potato-growing regions the differences in soil and climate conditions are very great. The number of potato varieties to be found is large and constantly increasing, some appearing to be very persistent.

Forest botany [India], R. S. HOLE (*Ann. Rpt. Bd. Sci. Advice India*, 1915-16, pp. 100-102).—A brief account is given of studies or observations on the ecology of sal (*Shorea robusta*); remedies for defective reproduction by sal; root disease (*Polyporus shoreæ*) of sal trees; the ecology of teak; *Trametes pini* as a cause of disease induced by lopping *Pinus excelsa*; and on the forest floras of the central provinces. A list of recent publications is included.

FIELD CROPS.

[Report of the agronomy department, Montana Experiment Station], A. ATKINSON (*Montana Sta. Rpt. 1916*, pp. 165-170).—This reports the results of variety tests with winter and spring wheat, oats, barley, annual hay and pasture crops, and root crops; cultural tests with peas; a comparison of continuous and alternate cropping on dry land; and a comparison of wheat alternating with bare fallow with wheat alternating with corn.

Kharkov winter wheat, with an average yield of 35.7 bu. per acre, has given the best results on dry land. Among the spring wheat varieties grown under dry-land conditions Pellissier has given the highest yield for a 7-year period, averaging 27.2 bu. per acre. Ghirka and Fife, good milling varieties, averaged 23.7 and 23.1 bu. per acre, respectively, for the same period, while Marquis gave a 3-year average yield of 33.1 bu. per acre and is deemed one of the best varieties for dry land. Under irrigation the highest yielding spring wheat was Stanley, with a 7-year average yield of 68.5 bu. per acre, but it possessed poor milling quality. Of the milling varieties, Scotch Fife and Marquis have given average yields of 63.3 and 52.4 bu. per acre, respectively. Purple Durum and Gharnovka, macaroni varieties, have averaged 65.3 and 62.6 bu. per acre, respectively, under irrigation.

The leading oat varieties under irrigation included No. 72, with an average yield of 119.4 bu. per acre, Myrick, with 114.9 bu., Silver Mine, with 113.9 bu., No. 10624, with 110.1 bu., and Banner, with 109.6 bu., all outyielding Swedish Select, the prevailing variety grown in the State. On dry land Sixty Day has given the highest average yield, 62.4 bu. per acre, while Swedish Select averaged 46.5 bu.

Among barley varieties grown under irrigation, New Zealand was first with an 8-year average yield of 86.1 bu. and Guy Mayle second with 67.8 bu. per acre. Oderbrucker has averaged 86.5 bu. for a 4-year period. White Smyrna, with a 5-year average yield of 52.9 bu. per acre, was first of the barley varieties grown on dry land.

Annual hay crops grown under irrigation included the following, with their respective yields of cured hay: Foxtail millet, 4.3 tons; Sudan grass, 3.8 tons; billion-dollar grass, 5.3 tons; vetch, 4.73 tons; and Johnson grass, 1.6 tons. Promising pasture crops tested under irrigation, with their yields in green weight per acre, were Dwarf Essex rape, which averaged 26 tons, and Thousand-Headed kale, which averaged 29.5 tons.

Root crops grown under irrigation for the past 3 years gave the following average acre yields: Mammoth Long Red mangles, 37.6 tons; Yellow Globe mangles, 30.1 tons; Giant Feed half-sugar beets, 19.7 tons; sugar beets, 13.5 tons; field carrots, 16.4 tons; field turnips, 20.5 tons; and Monarch rutabagas, 16.3 tons.

In a comparison of continuous and alternate cropping on dry land the following average results have been secured over a 6-year period:

Average yields obtained from continuous and alternate cropping on dry land for a 6-year period.

Crop.	Yield per acre.		
	Grown continuously.	Alternate crop and fallow.	Alternate crop and fallow. Manure applied to the fallow.
	Bushels.	Bushels.	Bushels.
Fall wheat.....	23.72	46.78	47.96
Spring wheat.....	23.11	37.83	39.55
Oats.....	55.69	71.76	71.77
Barley.....	35.68	49.44	49.94

Wheat alternated with bare fallow in comparison with wheat alternated with corn resulted in estimated average profits per acre of \$6.89 with wheat and corn and \$2.37 with wheat and fallow for a 7-year period at the Judith Basin substation. At the Huntley substation the average profits per acre over a 4-year period were estimated to be \$9.05 for wheat and corn and \$3.70 for wheat and fallow.

Field peas sown in drill rows 8 in. apart and in 24-in. rows, using 3 bu. of seed per acre, have given average yields of 44 and 42 bu. per acre, respectively, for the past 5 years. Plantings in 24-in. rows, using 1.5 bu. of seed, yielded 35.6 bu. per acre, while 30-in. rows have averaged from 30.3 to 36 bu. per acre.

[Field crops work in Tennessee] (*Tennessee Sta. Rpt. 1914*, pp. 269-271, 277-279).—(Reviewing the progress of work with field crops for 1914, brief notes are presented on cultural tests with red clover, alfalfa, cowpeas, wheat, and corn; on field tests with Sudan grass, honey sorghum, cotton, winter beardless barley, sweet clover, and smooth-headed millet; and on the value of the subsoil plow for Tennessee conditions.

Progress report, Substation No. 5, Temple, Tex., 1910-1914, D. T. KILLOUGH (*Texas Sta. Bul. 215 (1917)*, pp. 3-28, figs. 8).—This bulletin reports results of testing, improvement, and production studies with cotton, cowpeas, soy beans, Sudan grass, corn, and the grain and forage sorghums, together with rotation experiments and field tests comparing different methods of soil preparation. Attempts to establish satisfactory fruit, truck, and garden crops on the substation are briefly noted.

Data on rainfall from 1889 to 1914, inclusive, are presented, the annual precipitation varying from 20.45 to 50.28 in. with an average annual rainfall of 35.07 in. The summer months of 1912, 1913, and 1914 were especially dry, although the total annual precipitations amounted to 29.41, 43.65, and 46.74 in., respectively. Weather conditions were deemed more satisfactory for cotton than for corn.

Rotation tests with cotton resulted in yields amounting to 849.37 lbs. of seed cotton per acre for cotton grown in rotation and 522.9 lbs. for cotton following cotton. Similar tests with corn resulted in yields of 25.6 bu. per acre for corn grown in rotation and 17 bu. for corn following corn. Observations on the root rot disease, *Ozonium omnivorum*, of cotton in 1914 revealed the fact that a loss of 50 per cent was sustained from this disease by cotton grown on land continuously cropped to cotton, whereas in a 4-year rotation a loss of only 0.6 per cent occurred.

Leading cotton varieties in tests conducted during 1912-1914, inclusive, included Union Big Boll, Lone Star, and Mortgage Lifter, with average yields of lint cotton of 339.82, 339.39, and 317.34 lbs. per acre, respectively.

Variety tests with cowpeas for seed for the period of 1912-1914, inclusive, resulted in average yields ranging from 50.23 lbs. per acre for Peerless to 404.25 lbs. for New Era. Cowpea variety tests for forage in 1912 resulted in yields ranging from 966 lbs. of cured hay per acre for Peerless to 3,476 lbs. each for Iron and Clay.

Soy bean variety tests conducted from 1912-1914, inclusive, gave average yields of seed ranging from 1 bu. per acre for Jet to 3.9 bu. for Meyer.

Satisfactory yields of grain are said to have been obtained with the sorghums, especially feterita which is deemed to have its greatest value as a catch crop. Of the saccharin sorghums tested Sumac has given uniformly better yields of forage and hay. Sorghums and cowpeas grown together for hay in 1912 indicated that better results could be obtained by growing the crops separately and mixing the hay when feeding. Sumac sorghum gave better results than Amber for such mixtures, while there appeared to be no prefer-

ence among the cowpea varieties tested. A planting rate of 20 lbs. of seed per acre consisting of 1 part cowpeas and 8 parts sorghum gave a yield of 8,350 lbs. of cured hay per acre.

In corn variety tests conducted during 1913 and 1914 Surecrops, Mammoth White, and Cater were the leading varieties, with average yields of 33.87, 31.74, and 31.06 bu. per acre, respectively. Ear-to-row testing to determine the relation between certain characters of corn and yield is held to indicate that seed corn should be selected from a good stand of tall, leafy plants which are relatively heavily stalked and that large, heavy ears with deep grains should be chosen.

Corn grown in rows 3 ft. apart, with the plants spaced 30, from 30 to 40, and from 70 to 80 in. apart in the row, gave average yields of 18.91, 24.23, and 19.22 bu. per acre, respectively, for the period of 1912 to 1914, inclusive. Growing the same number of stalks of corn on the land but with different spacings between hills resulted in average yields for the period of 1913-14, inclusive, amounting to 28.32 bu. per acre for hills spaced 3 by 3 ft., 23.06 bu. for hills spaced 6 by 1.5 ft., and 22.33 bu. for hills spaced in pairs of 3-ft. rows 9 ft. apart, the stalks 18 in. apart in the row.

Corn grown alone and with cowpeas sown during the latter part of the growing period of the corn resulted in average yields of 21.68 and 20.6 bu. per acre, respectively, for the period of 1912-13, inclusive.

Field tests with various grasses have been undertaken to find a grass adapted to planting in rotation. Rhodes grass gave a yield of 3,823 lbs. of cured hay per acre in 1914, and rescue grass grown for seed yielded as high as 380 lbs. per acre. Several hybrids of Texas blue grass and Kentucky blue grass are reported as promising for this region. Sudan grass seeded broadcast at rates of 20 and 30 lbs. per acre in 1913 gave yields of 4,000 and 2,800 lbs. of cured hay per acre, respectively. Planted in 18- and 36-in. rows at a 10-lb. seeding rate, Sudan grass yielded 556 and 361 lbs. of seed per acre, and 2,950 and 2,650 lbs. of cured hay per acre, respectively. Plantings of Sudan grass in 1914 gave an average yield of 6,534.5 lbs. of forage and 147.6 lbs. of seed per acre.

The use of fertilizers and lime is said to have been less profitable on the soils of the substation than crop rotation or the use of improved crops.

October plowing for cotton in 1913 resulted in an average yield of 769.63 lbs. of seed cotton per acre as compared with 743.2 lbs. for January plowing. Depth-of-plowing tests resulted in yields of seed cotton ranging from 735 lbs. per acre for a plowing depth of 4 in. to 868.12 lbs. for a plowing depth of 12 in.

Cotton grown on land dynamited in seed bed preparation gave an average yield of 768 lbs. of cotton per acre for the period of 1913-14, inclusive, while cotton grown on land not dynamited yielded 793.7 lbs. of seed cotton. Corn grown on dynamited land in 1913 yielded 23.7 bu. per acre as compared with a yield of 25.75 bu. for corn grown on land not dynamited.

[Report of field crops work], F. WATTS (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Antigua, 1915-16, pp. 5-13, 14, 19, 20*).—Continuing work previously noted (E. S. R., 36, p. 735), variety tests are reported with sweet potatoes, cassava, eddoes and tannias, and yams for the year 1915-16.

Fertilizer and distance-of-planting tests with corn are briefly noted. A yield of 13.6 bu. of shelled corn per acre was realized from a fertilizer treatment of 30 lbs. of phosphoric acid as basic slag and 40 lbs. of potash as sulphate of potash, as compared with a yield of 6.3 bu. from the untreated check. Twelve bu. per acre were obtained from a 40-lb. application of potash as sulphate alone. Later plantings to study the residual effect of the fertilizer treatments gave a

yield of 9.2 bu. for the untreated check and 8 bu. for the phosphoric acid and potash treatment. The distance-of-planting experiments indicated that slightly higher yields were obtained from plantings of 2 by 2 ft., although the yields were not far superior to those secured from plantings of 2 by 4 ft.

Hybridization and selection work with corn and cotton is noted.

The development of the fiber industry in Antigua and the production of sisal and hemp are briefly discussed.

Plants indigenous to Chile and their production, K. REICHER (*Bol. Soc. Fomento Fabril [Chile]*, 32 (1915), Nos. 7, pp. 481-486; 10, pp. 679-684; 11, pp. 776-784; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 5, pp. 656-659).—The most promising plants indigenous to Chile are listed, described, and their uses discussed. The species mentioned include cereals and other plants with edible seeds; tubers and roots; fiber crops; plants used for tanning; plants containing saponin; dye plants; plants containing gums and resins; medicinal plants; fruit-bearing trees and forest trees; and miscellaneous plants.

[**Field experiments at the Bezenchuk Experiment Station**], L. I. KOLTSOV (*Sel'k. Khoz. i Lesov.*, 251 (1916), July, pp. 301-323).—Method-of-sowing tests are reported with spring wheat, oats, and millet.

The best results with spring wheat were obtained from rows 5 in. apart. For oats, seeding in two rows 3.5 in. apart, with 14 in. between each pair of rows, gave the best results. Millet yielded best when sown in rows 14 in. apart. Cultivation of the intervals between the rows gave excellent results, especially with millet.

[**Report of field crops work in Assam**], J. W. MCKAY (*Ann. Rpt. Agr. Expts. Assam, 1916*, pp. 7-25, 40-42, 49-60, 88-91, 104-107).—Extensive variety and cultural tests at four experimental centers in Assam are reported with sugar cane, potatoes, corn, cotton, cowpeas (for seed and forage), and rice.

An increased yield of approximately 100.78 lbs. of grain and 191.28 lbs. of straw per acre was obtained from rice on "warped" land, a sterile marsh land reclaimed for rice cultivation and covered with a 3-in. layer of soil deposited from water.

[**Report of field crops work**], G. S. HENDERSON and G. ABDUR RAHMAN (*Dept. Agr. Bombay, Ann. Rpt. Agr. Sta. Landhi, 1913-14*, pp. 1-7; 1915-16, pp. 2-8).—Field tests are reported for 1913-14 and 1914-15 with rotations of potatoes, the principal crop of the region, and peanuts, millet, corn, legumes (soy beans and *Dolichos lablab*), and sunn hemp used as a green manure. Other tests are noted with velvet beans, kidney beans, and green gram as forage crops, and of certain minor products such as jute, hemp, indigo, sweet potatoes, yams, and several native crops.

In 1914, of 2,000 lbs. of seed potatoes stored in wooden boxes, 240 lbs. were reported as a loss.

[**Report of field crops work**], H. CLAYTON (*Rpt. Dept. Agr. Burma, 1916*, pp. 3-7).—Field tests with rice, cotton, sesame, peanuts, castor beans, sugar cane, wheat, pigeon peas, Madagascar beans, and tobacco at the several experimental centers of Burma are reported for the year ended June 30, 1916.

[**Report of field crops work at the Palur Agricultural Station**], R. THOMAS and J. CHELVARANGA RAJU (*Dept. Agr. Madras, Rpt. Palur Agr. Sta., 1914-15*, pp. 2-15; 1915-16, pp. 4-25; 1916-17, pp. 26).—Variety, rotational, and fertilizer tests with peanuts on dry and irrigated land, variety and fertilizer tests with rice, and variety tests with sugar cane are reported for 1914 to 1917, inclusive.

Continued green manuring of paddy land with daincha has resulted in a steady improvement of the land. A number of green manure crops have been

compared, indigo giving the best average results for the past eight years. Green manure supplemented by 1 cwt. of bone meal and 0.25 cwt. of potash increased the yields of rice by 426 lbs. per acre in 1916, with a similar increase of 474 lbs. in 1915 and a four-year average increase of 138 lbs.

[Report of field crops³ work at the Samalkota Agricultural Station]. G. R. HILSON and D. BALAKRISHNAMURTI (Dept. Agr. Madras, Rpt. Samalkota Agr. Sta., 1913-14, pp. 4-18; 1914-15, pp. 2-31; 1915-16, pp. 2-21; 1916-17, pp. 18).—Variety, cultural, and fertilizer tests with sugar cane and rice (both wet and dry paddies) are reported for 1913 to 1917, inclusive.

Tests on limed and unlimed sugar cane plats showed an increased yield of 740 lbs. per acre in favor of the unlimed plat in 1916. Applications of 1,640 lbs. of castor-oil cake showed increased yields in 1915 and 1916 over applications of 10 tons of cattle manure and 820 lbs. of castor-oil cake.

Plowing the dry rice paddies resulted in increased yields of both grain and straw over the unplowed paddies. The residual effects of castor-oil cake alone and in combination with potash and acid phosphate are reported in yields of rice grain and straw for each year from 1900 to 1917, inclusive. Applications of 820 lbs. of castor-oil cake and 2 cwt. of acid phosphate appear to have given consistently higher yields than the untreated checks, whereas the castor-oil cake supplemented by 1 cwt. of potash has given yields lower than the checks. The green-manured paddy land supplemented by 2 cwt. of acid phosphate has given increased yields since 1900.

Tests with complete fertilizers supplemented by rice straw are also reported, together with their residual effects. Applications of 4 cwt. of ammonium sulphate, 2 cwt. each of acid phosphate and potassium sulphate, and 5 tons of paddy straw have shown increased yields of grain in the main crop four years out of six, and in the second crop two years out of four, over a similar fertilizer treatment without the straw. The yield of straw has been increased each year since 1911 in the main crop, and in 1914 and 1915 in the second crop by the addition of the straw.

Grasses and clovers under irrigation, J. M. PITT (Agr. Gaz. N. S. Wales, 28 (1917), No. 2, pp. 77-82, figs. 4).—In addition to the grasses and clovers mentioned previously by McDiarmaid (E. S. R., 33, p. 228) the following are recommended as worthy of trial in establishing pastures under irrigation in New South Wales: *Lolium westernnoidicum*, *Bromus japonicus*, *Eriochloa annulata*, *Andropogon intermedius*, *Trifolium subterraneum*, *Melilotus alba*, *Medicago tuberculata*, *M. hispida*, *M. hispida sardoa*, and *M. hispida reticulata*.

Phalaris bulbosa is reported as being the most promising winter, spring, and early summer perennial yet tested. *B. inermis*, *Sctaria nigrirostris*, and *Bouteloua curtipendula* gave good results, while of the native grasses previously mentioned *Panicum prolutum* and *A. sericeus* are reported as yielding large quantities of forage and seed.

The Egyptian, red, and crimson clovers again gave good results.

Effect of plants on others, B. L. HARTWELL (Bul. R. I. State Col., 12 (1917), No. 4, p. 23).—In 1913 buckwheat followed onions, rye, buckwheat, and redtop in the field without fertilizer, with yields amounting to 21, 21, 13, and 10 bu. per acre, respectively. The same crops were grown for two years in pots under various fertilizer treatments, and were again followed by buckwheat in 1916, resulting in yields in the same relative order as noted above.

Alsike clover sown in 1916 yielded approximately 2 tons of hay per acre after potatoes, rye, redtop, and squashes, 1.4 tons after red clover, and 1.3 tons after alsike clover itself.

Eureka silage corn sown at the rate of 15 lbs. per acre with 15 lbs. of soy beans yielded nearly as much corn as where 15 lbs. of corn were planted alone, the total yield being increased about one-sixth by the beans. Doubling the rate of seeding resulted in a decreased yield of corn scarcely compensated by the beans. It was concluded that the beans had no positive effect in increasing the nitrogen content of the corn, although that of the mixture was increased.

Berseem as a new fodder crop for India. G. S. HENDERSON (*Agr. Research Inst. Pusa Bul.* 66 (1916), pp. 8, pls. 3; *abs. in Nature [London]*, 99 (1917), No. 2476, p. 131).—The cultivation of berseem (*Trifolium alexandrinum*) as a forage crop in Egypt is described. The crop is usually pastured or employed as a soiling crop or for seed production. Berseem hay is said to be of excellent quality but not yet of any great economic importance.

The castor oil plant in Egypt. V. MOSSÉNI (*Bul. Union Agr. Égypte*, 15 (1917), No. 118, pp. 29).—The cultivation of the castor oil plant (*Ricinus communis*) in Egypt is discussed in detail, and studies of the influence of soil and climate upon oil production reported.

The weight of seed and percentage of hulls and seed were found to vary with the variety, and in the same variety with the region, the season, and the crop. The physical condition of the soil is said to have less effect on the crop than excessive soil moisture or excessive alkalinity of the soil, these last-named properties affecting the weight of the seed and, to an even greater extent, the percentage of hulls and kernels.

The oil content of the seed was found to be largely dependent upon atmospheric conditions prevailing at the time of the formation and maturation of the seed, varying with the variety, the locality, the season, and the crop. The oil content was apparently increased in the same variety when the latter was transported from the north to the south and diminished with reversed conditions. It also appeared that there was a correlation between grain weight and oil content.

Ordinary white clover seed versus wild white clover seed. T. J. JENKIN (*Jour. Bd. Agr. [London]*, 23 (1917), No. 12, pp. 1202-1208).—Numerical data are presented and discussed in an effort to determine the real differences existing in permanent pasture formation where equal quantities of ordinary white clover and wild white clover were used. The experiments were begun in 1914 at a number of centers where permanent pastures were to be established, and observations on the percentage of area covered by white clover at the end of 18 and of 30 months reported. The seeding mixtures compared included wild white clover, ordinary white Dutch clover, and ordinary white clover. The observations briefly summarized were as follows:

Wild white clover demonstrated its superiority over ordinary white clover in most cases at about 18 months after seeding. In all cases this superiority became obvious by 30 months after seeding unless development had been checked. The average percentage of area covered by white clover 30 months after seeding was 19.7 for wild white clover, 2.13 for ordinary white Dutch, and 1.74 for ordinary white clover.

Analyses of agricultural yield.—III, The influence of natural environmental factors upon the yield of Egyptian cotton. W. L. BALLS (*Phil. Trans. Roy. Soc. London, Ser. B*, 208 (1917), No. 352, pp. 157-223, figs. 19).—Supplementing an examination of the effects of such environmental factors as distance and date of planting (*E. S. R.*, 36, pp. 36, 37) on the yield curve of Egyptian cotton, the author presents a study of the following factors: Soil fertility, hardpan (soil texture), soil depth, shortage of soil water, overwatering, root asphyxiation, weather, and climate. Statistical evidence secured from observa-

years extending over the period of 1900-1913 and at several centers in Egypt forms the basis upon which the studies were made. The factors were studied chiefly in their effects upon the flowering curve, which represents the daily rate of flowering of an average plant, and the relation between the formation of this curve and the antecedent growth processes and subsequent yield outlined.

The flowering curve and consequently the yield curve were shown to have a typical form under good cultural conditions. Poor cultivation is defined as any condition that allows a factor to become limiting when it need not be so, thereby deforming the curve.

The differences of behavior of various cotton crops appeared to be inevitable consequences of the known environmental conditions, provided only that due regard be paid to the distinction in time between the causation of any effect and its manifestation. To denote this latter distinction the author uses the term "predetermination." Daily fluctuations of the flowering curve constitute an example of predetermination, since they are controlled by weather conditions which obtained a month before the flowers opened, and simultaneous fluctuations in the same direction may be shown by all cotton fields in Egypt.

Observations are presented with regard to the function and dimensions of the absorbing part of the root system as distinct from the merely conducting portions. By combining the analyses made in these studies with data concerning the commercial aspect of Egyptian cotton it has been shown that root asphyxiation produced by a rising water table is the principal cause of the deterioration in yield per acre which the crop has suffered.

In discussing the physiological outlook essential for an effective analysis of agricultural yield, the author asserts that the method of study employed in these investigations is a matter of adjustment depending only on the choice of cardinal points for observation in the crop to be studied, and that a superposition of the continuous observation method upon the scattered small-plot method may be expected to link plant physiology more closely to agriculture. With a proper conception of the law of limiting factors, as advanced by F. F. Blackman, and of the frequent predetermination of their effects, there is thought to be abundant opportunity for advances in the knowledge of so-called "crop physiology" by applying these methods of continuous registration to plant development. The limitations of the plant-development curves as tools for purposes of research are (1) that the data required for their construction must almost invariably be obtained daily throughout the season, since the day is the real time limit in which a plant measures its experiences, and (2) that they necessitate considerable labor. Opposed to these disadvantages is the fact that they abolish the probable error of plant experiments, thereby achieving good results with controlled areas otherwise far too small if the yields were not thus analyzed. The author continues:

"It is probable that the solution lies in compromise, by first establishing a set of standard data, as complete as possible, for any given crop and district, with which any subsequent observations of salient features could be compared. The establishment of such a set for the Ghezeh Cotton Experiment Station was one of the author's chief aims. . . . The desired extension of the observations to minor outlying stations in other parts of Egypt would have provided not only a system of precise crop reporting, on the lines of a weather report, but also a system of crop forecasts.

"Our principal general conclusion is, therefore, that Blackman's law of the limiting factor provides the key by which the intricate relations of any crop to its environment may be satisfactorily unlocked, provided only that these

reactions are expressed numerically, with definable significance; that they are duly referred in their origin to that stage of the plant's development at which they were actually induced; [and] that the crop is treated as an average plant whose physiology is the subject of investigation."

Arborescent cotton plants, "de Motril" and "Caravonica," C. RIVIERE (Bul. Soc. Nat. Acclim. France, 63 (1916), No. 2, pp. 46-55; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 5, pp. 683-684).—(On the basis of the history of the two arborescent cotton plants named, the author maintains that cotton is capable of infinite variation and is much affected by environment and cultural methods. From this it follows that the habit of growth, shape of leaves, and size of inflorescence, as well as the length and character of the staple, are not fixed characters upon which economic cultivation can be established, but that preliminary tests must be made to determine the qualities of the plant.

He regards de Motril as closely related to *Gossypium hadyanum*, described by Todaro as coming from the Algiers Experimental Gardens and which according to the author, is a long-stapled Georgia much resembling Sea Island from which Caravonica was derived. The latter had a strong tendency to degenerate into common varieties.

As experimental proof of his hypothesis, the author recalls that some neglected plants of *G. herbaceum* found by him on the dunes of Biserta produced in the Algiers Experimental Gardens individuals with luxuriant growth which did not at all appear to have had a common origin. On the other hand, plants raised from the seed of equally fine individuals, when grown under unfavorable soil and cultural conditions, produced offspring to which different origins both as regards country and race would certainly have been attributed.

Some notes on malangas, R. S. CUNLIFFE (Agriculture [Cuba], 1 (1917), No. 3, pp. 21-29, figs. 5).—The production of Blanca and Amarilla malangas in Cuba is described. The composition of these two varieties compared with that of potatoes, sweet potatoes, and cassava, as determined by analyses made at the Maine Experiment Station, show that they compare favorably with the other crops. The albuminoid ratio was found to be 1:16 for Blanca and 1:10 for Amarilla malangas.

Cultural tests with large and small seed tubers of Amarilla malangas gave an increased yield of 1,920 kg. (approximately 4,224 lbs.) per acre for the large seed. Tubers cut to sets of several eyes gave an increased yield of 1,000 kg. per acre over large, whole tubers and of 3,824 kg. over small, whole tubers.

Spring oat production, C. W. WARBURTON (U. S. Dept. Agr., Farmers' Bul. 892 (1917), pp. 22, figs. 9).—This is a revised edition of Farmers' Bulletin 424 (E. S. R., 24, p. 237).

A study in the assimilation of nutrients by the rice plant, JATINDRA NATH SEN (Agr. Research Inst. Pusa Bul. 65 (1916), pp. 13, pl. 1; abs. in Nature [London], 99 (1917), No. 2476, p. 131; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 8 (1917), No. 3, pp. 359, 360).—Studies of the assimilation of nitrogen, phosphoric acid, and potash in the rice plant in India are reported. The life of the plant was divided into six stages; namely, seedling, transplanting, pre-flowering, flowering, milk, and dead ripe, and the percentage of total nitrogen, phosphoric acid, and potash contained in the root, stem, leaf, ear, grain, and chaff determined and reported in tabular form, together with the content of total nitrogen, phosphoric acid, and potash per plant. The feeding value of the different parts of the rice plant at the various stages of growth was also determined. From the data secured the following general conclusions were drawn:

The total dry matter in rice plants increased up to maturity, the greatest increase occurring, however, before the formation of the flowers. The percentage of nitrogen showed a steady and continuous decrease from the first to the last period of growth, the most rapid decline being noted in the second period. There was a very slight increase in total nitrogen in the roots during the last stages. The phosphoric acid content of the above-ground portions varied but slightly during the seedling and flowering stages, while in the roots there was a slight but regular decline through all stages. The percentage of potash in the above-ground parts increased from the seedling to the pre-flowering stage, after which there was a decline. In the roots the decline set in after the transplanting stage. As the ears formed, a concentration of nitrogen, phosphoric acid, and potash occurred in the grain at the expense of the other parts of the plant. The assimilation of the three principal plant food elements was practically completed by the flowering stage, hence the earlier stages were more or less critical. No downward transmigration of the absorbed nitrogen and potash into the soil was observed. With a yield of 900 lbs. of dry grain the soil suffered a loss of 29.33 lbs. of nitrogen, 9.64 lbs. of phosphoric acid, and 49.69 lbs. of potash per acre when the grain and straw were removed.

Rye growing in the Southeastern States, C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul. 894* (1917), pp. 14).—The advantages of increased rye production and the conditions under which rye is deemed preferable to wheat in the southeastern United States are outlined. Field practices and cultural methods employed in growing the crop are discussed and the principal weeds and insect and disease enemies of the crop noted.

Sorghums for forage in South Dakota, M. CHAMPLIN and G. WINRIGHT (*South Dakota Sta. Bul. 174* (1917), pp. 624-645, figs. 15).—This bulletin reports the results of comparative trials of different sorghums and outlines directions for growing the crop based on field experiments conducted partly in cooperation with the U. S. Department of Agriculture on the station farms at Brookings, Cottonwood, Eureka, Highmore, and Vivian. The experimental work covered the period from 1912-1916, inclusive.

The sorghums are regarded as valuable catch crops and especially profitable under weather conditions unfavorable to corn, but were not otherwise deemed superior to the latter. Sudan grass proved best for hay purposes, varieties of amber cane such as Minnesota Amber and Dakota Amber for high tonnage of coarse forage, and Dwarf Milo for silage. Sudan grass gave the highest average yields when grown in drill rows 6 and 12 in. apart, amounting to 2.84 and 2.63 tons per acre, respectively, although satisfactory yields were secured when the crop was grown in cultivated rows. Amber cane and Dwarf Milo gave the best results when grown as cultivated crops. Seeding from May 20 to June 1 or later is recommended and the importance of shallow seeding emphasized.

Sugar beets in South Dakota, J. H. SHEPARD and R. C. SHERWOOD (*South Dakota Sta. Bul. 173* (1917), pp. 592-620, figs. 12).—This reports the continuation of work with sugar beets, previously noted (*E. S. R.*, 29, p. 635), giving a brief discussion for each season from 1913 to 1916, inclusive, together with tabulated data showing the results of variety tests for each year.

Better results were obtained by analyzing the mother beets in the spring and planting immediately rather than by removing the roots from storage for analysis during the winter. The loss in sugar content during storage is estimated to be about 2 per cent. The mother beets selected from the different varieties are shown a variation in sugar content ranging from 18 to 22 per cent.

The highest average tonnage for six years has amounted to approximately 13 tons per acre for 18-in. rows.

Although it has been demonstrated that commercial beet seed production is possible and profitable in the State, it is not deemed feasible for the individual farmer but should more properly be financed and operated by sugar beet seed companies.

Velvet beans, J. R. FAIR, S. H. STARR, and P. O. VANATTER (*Ga. State Col. Agr. Circ. 48 (1917), pp. 4*).—The production and use of velvet beans in Georgia are briefly outlined. In a tabular comparison of the yields of 14 varieties Medium Early showed the highest yield for 1916, 24.62 bu., with a yield of 8.15 bu when sown with corn. Ninety-Day Bunch gave the highest yield when sown with corn, 11.55 bu. The latter variety required 135 days to mature, the former 170.

Velvet beans in Mississippi, E. B. FERRIS (*Mississippi Sta. Bul. 179 (1917), pp. 19, figs. 4*).—Approved field practices and cultural methods for velvet bean production in Mississippi are outlined and the value of the crop as a feed and for soil improvement noted. It is concluded from "15 years' experience on the cut-over lands of south Mississippi . . . that cattle and hogs with corn and velvet beans will come nearer solving the problem of profitable agriculture for the section as a whole than all other things combined."

Growing winter wheat on the Great Plains, E. C. CHILCOTT and J. S. COLL (*U. S. Dept. Agr., Farmers' Bul. 895 (1917), pp. 12*).—The adaptation, relative value, and cultural methods of winter wheat production are briefly reviewed for Montana, North and South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, Texas, and New Mexico.

Limited rainfall is regarded as the controlling factor in crop production in the Great Plains, the relation between soil moisture at seeding time and yield being much closer with winter wheat than with other crops. Well-prepared land, summer tillage, and a sufficient moisture supply to a depth of 3 ft. are deemed essential to a successful crop.

In the northern section of the Great Plains winter wheat can be replaced with spring wheat without serious loss. In the central section winter wheat is deemed superior to spring wheat, and can not be replaced by the latter without serious loss. In the southern section winter wheat is regarded as less certain and less productive than farther north, and can not be replaced by spring wheat.

Proportion of grain to sheaf as a factor in wheat selection, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 28 (1917), No. 2, pp. 91-94*).—The proportion of grain to sheaf was determined for 36 varieties of wheat at Cowra in 1914, and for 55 varieties in 1915, in an attempt to ascertain whether a high proportion of grain to sheaf is generally associated with high grain yield per acre. The results obtained indicated that a rather higher proportion of grain to sheaf was present in the heavier-yielding varieties, but that the proportion varied with the season.

Plants of two strains, "A" and "B," of a hybrid Yandilla King × Zaff in the sixth generation were harvested in 1914 to secure a wheat with a high proportion of grain to sheaf. Strain A appeared to be constant, while Strain B appeared to be mixed. In 1915 seed was sown from one plant "Q," representing the A strain, and from two plants "D" and "E," representing the B strain. Q reproduced the uniform results of the parent, but D and E appeared to include two strains, each one yielding a higher proportion of grain to sheaf than the other. The few highest-yielding plants, however, had a medium to low proportion of grain to straw, and it is concluded, therefore, to be unwise to pursue selections for this quality except as of secondary importance to that

of yielding ability. High grain yields were not associated with a very high proportion of straw, but neither were they correlated with a very low proportion. The results seem to indicate that as between plants of the same variety grass yield is sufficient to determine the most productive plants for grain.

Seed Reporter (*U. S. Dept. Agr., Seed Rptr., 1* (1917), No. 1, pp. 4).—This marks the initial issue of a monthly publication dealing with material that may arise from time to time relative to the production, handling, and marketing of seeds, including the following subjects: Seed crop movement; receipts, shipments, and imports of seeds; available supplies, demand, prices, and quality of seeds; commercial varieties of seeds; special crop reports; seed marketing and seed crop studies; crop estimates; reports of the seed stocks committee; and miscellaneous news items deemed of interest and value to seed growers and dealers.

The current number includes a brief outline of the purposes and activities of the committee on seed stocks, special articles on the storage of seed wheat in the Northwest, the seed-corn situation in the Northwest, and the soy-bean situation in eastern North Carolina. Statistics are presented on marketing and production surveys of timothy in Iowa, Minnesota, Missouri, and Illinois; on alfalfa in Kansas; Kentucky bluegrass in Kentucky; redtop; orchard grass in Kentucky and Indiana; clover seed in Wisconsin and Minnesota; movements of meadow fescue; and on imports of forage-plant seeds permitted entry into the United States.

A seed key to some common weeds and plants, E. L. PALMER (*Proc. Iowa Acad. Sci., 23* (1916), pp. 335-394, figs. 41).—Seeds of 118 common weeds and plants, many of which occur as adulterants in the seed of red, white, and alsike clovers, alfalfa, timothy, and redtop, are described, and a key provided for their identification. The object of the work is to furnish a method for accurately determining the names of various seeds and seedlike fruits, with the express purpose of detecting adulterants in commercial seeds, to aid in determining plants in the fruiting condition when the flower parts are too far advanced for the usual identification methods and to serve as a check in determinations from a study of the flowers. A brief bibliography of literature relating to seed study is included.

HORTICULTURE.

Vegetable forcing, R. L. WATTS (*New York: Orange Judd Co., 1917, pp. XX+431, figs. 156*).—A practical treatise on vegetable forcing. The first part of the book discusses greenhouse construction and heating; soils; manures, lime, and fertilizers; soil preparation; soil sterilization; insect enemies and their control; diseases and their control; starting plants; watering, heating, ventilating, and shading; and marketing. Separate chapters then deal with the history, importance, and methods of forcing asparagus, rhubarb, lettuce, cauliflower, radish, tomato, cucumber, muskmelon, and miscellaneous vegetables. Systems of cropping, the management of frame crops, and mushrooms are also discussed.

The work as a whole is based upon commercial practice and the recent literature of the subject.

The California vegetables in garden and field, E. J. WICKSON (*San Francisco: Pacific Rural Press, 1917, 4. ed., rev. and enl., pp. 319, pls. 23, figs. 6*).—The present edition of this work (E. S. R., 29, p. 435) is revised and extended to include recent practice in vegetable growing.

Vegetable growing, G. TRUFFAUT (*Produisez des Légumes. Versailles, France: Author, 1917, pp. 128, pl. 1, figs. 47*).—A cultural treatise including a monthly working calendar, prepared with special reference to French conditions.

Everyman's garden in war time, C. A. SELDEN (*New York: Dodd, Mead & Co., 1917, pp. XIV+338*).—A popular treatise on home gardening and fruit growing, including a weekly working calendar.

Report of the State horticulturist, C. L. WILKINS (*Agr. of Maine, 1916, pp. 38-76*).—A brief report on the inspection of nurseries and orchards and premises, as well as foreign-grown nursery stock imported into the State of Maine during 1916. Short papers on markets by H. A. Emerson and on birds of the orchard by W. E. Powers are also included.

[**Report of horticultural investigations**], O. B. WHIPPLE (*Montana Sta. Rpt. 1916, pp. 175, 176*).—Mulching experiments with vegetables were continued during the year (*E. S. R.*, 36, p. 236). Cabbage, cauliflower, endive, and turnips were slightly improved by mulching. Warm season crops were noticeably retarded by the mulch, probably due to the reduction in soil temperature.

The season's studies of premature seedling of celery again showed that moving the plants to a cold frame early was one of the most important factors favoring premature seedling. Of 36 varieties of early sweet corn tested the most promising ones were Early June, Indian, Burbank 86, Early Mayflower, and Early Malcom. Of six varieties of the common dry beans, Red Indian and Yellow Indian matured best. In storage experiments with cabbage, Danish Ballhead, Mammoth Rock Red, and Danish Roundhead stored best. Of 14 varieties of strawberries tested at the home station, Early Ozark, Senator Dunlap, Marshall, and Kellogg Prize passed the winter of 1915-16 very well without protection.

The results of investigations being carried on at the horticultural substation have been reported in a recent bulletin (*E. S. R.*, 37, p. 241).

Market gardening (*Sta. Agron. Finistère et Lab. Dept. Bul., 1916, pp. 162-124*).—Fertilizer experiments with all of the important vegetables grown in the Department of Finistère, France, are here reported.

Head lettuce for Ohio greenhouses, S. N. GREEN (*Mo. Bul. Ohio Sta., 2 (1917), No. 11, pp. 370-374, figs. 2*).—The results are given of a comparative test of leaf and head lettuce conducted in the station greenhouses during the past five or six seasons.

Leaf lettuce of the Grand Rapids type was found to grow faster and make heavier heads than the head lettuce during the fall months. During the winter months head lettuce matured somewhat quicker and produced about the same weight heads as leaf lettuce. Experience during the past six seasons has shown that varieties of head lettuce may be bred to a degree of disease resistance. Soil sterilization for the control of diseases has proved of considerable value in raising lettuce, but renewal of the soil every year has given the best results.

In view of the possible overproduction of the loose-leaf Grand Rapids lettuce in Ohio, greenhouse men are advised to experiment with head lettuce and develop strains resistant to disease and tipburn. Head lettuce marketed by the station during the winter months was sold without difficulty at a good price.

Growing Bermuda onion seed in the southwestern United States, S. C. MASON (*U. S. Dept. Agr., Bur. Plant Indus. [Pub.], 1917, pp. 6, figs. 3*).—The author briefly reviews the present status of the Bermuda onion industry in the Southwest and gives an account of experiments in the production of Bermuda onion seed at the Cooperative Testing Station, Sacaton, Ariz. Suggestions are also given relative to the selection of seed stock bulbs, planting, culture, and harvesting the seed. The author concludes that there seems to be no reason why all the American demand should not be supplied with home-grown seed, but that such production should not be undertaken outside of limited areas in southern Arizona and California having the requisite mild winter temperature and dry air of the summer season.

Storing vegetables for winter, M. C. MERRILL (*Utah Sta. Circ. 26 (1917)*, pp. 1-4).—This circular discusses the fundamental principles of vegetable storage, storage requirements, types of storage, and storage conditions for different types of vegetables.

The propagation of fruit trees, A. and GABRIELLE L. C. HOWARD (*Sci. Rpts. Agr. Research Inst. Pusa, 1916-17*, pp. 48-50).—Experiments conducted at the Fruit Experiment Station at Quetta, Baluchistan, have demonstrated that the fruit stocks generally used in growing peaches, nectarines, plums, apricots, etc., in the damp soils of Great Britain and the north of France are quite unsuitable for the hot, dry soils of Baluchistan. On the other hand, such stocks as Mariana, myrobalan, mahaleb, and Jaune de Metz Paradise have done exceedingly well.

Cross-pollination experiments in 1916 and 1917, M. VAN OIJEN (*Maandbl. N. Ver. Land. Pomol. Ver., 7 (1917)*, No. 11, pp. 164-176, pl. 1, figs. 2).—The results are given of cross-pollination experiments conducted with cherries at Maastricht, Holland, in 1916, and of similar experiments with pears and apples conducted in a private fruit garden in 1917.

Some observations on the growth of apple trees, J. H. GOURLEY (*New Hampshire Sta. Tech. Bul. 12 (1917)*, pp. 3-38, figs. 9).—In connection with the long-continued orchard management study being conducted at the station (E. S. R. 37, p. 833) annual growth measurements of mature apple trees growing under different systems of cultivation were made for a period of nine years, and daily growth measurements were made for the seasons 1913, 1914, and 1915. The present paper presents data and observations on these measurements, together with data recorded in 1916 showing the effect of various systems of cultivation on soil temperature.

Soil temperature records were taken almost daily from April 13 to September 20 in the following five plats: Permanently in sod, clean cultivation each year, cultivation with a cover crop, cultivation with a cover crop and a complete fertilizer applied each spring, and a plat similar to the last, with the complete fertilizer high in nitrogen. During the early spring the sod plat was the warmest and those having a heavy mat of cover crops were next lowest in temperature. The clean tilled plat and the tillage cover crop plat to which no fertilizers had been added showed the highest soil temperature. No soil temperatures were taken during the winter months, but observations were made on the depth to which different plats were frozen on March 6. The results in general indicate that soil temperature is warmest under the sod plat, followed by the plats with fertilized cover crops, and the coolest under the clean culture and light cover crop plats during the winter months. During the summer months the soil temperature runs lowest under the heaviest vegetation and highest under clean culture.

In the ninth year of this experiment the trees under a system of cultivation with cover crops exceeded in annual twig growth the trees in sod by 80 per cent. All the plats receiving a complete fertilizer in addition to cultivation and cover crops showed a marked increase in twig growth after the sixth year of the experiment and in the ninth year these plats averaged 26 per cent greater twig growth than the plat without fertilization. A difference in color of the foliage, however, was not noticeable until the ninth year and no increase in yield has yet occurred. The clean culture plat did not average as great an annual twig growth in the second 4-year period of the experiment as in the first 4-year period, but in the ninth year was 58 per cent greater than the sod plat. The yields, as yet, have not been so affected in the clean culture plat.

"The daily growth was more or less erratic each season, i. e., not following consistently any external factor under observation. The growth curve followed the air temperature more closely, however, than any other external factor recorded. There is no close correlation between the humidity curve and growth curve. It is not possible to control the separate factors under field conditions. These conclusions are based on 43,000 measurements during three seasons.

"The growth is much more readily affected by external factors in the early period of its growth than when it is approaching the resting period. The grand period of growth in this orchard was a period of about 25 days (3 years considered)." The "grand period" as here used refers to the period in which practically all the growth is made, beginning somewhere between May 20 and 25 and practically ceasing the latter part of June.

[Orchard cover crops]. H. A. MORGAN (*Tennessee Sta. Rpt. 1915, p. 116*). Experiments conducted at the west Tennessee station with Japan clover as an orchard legume for summer and winter cover indicate that Japan clover taxes too heavily the water supply of a young orchard to permit growing it close to the tree. It is killed by the first freezes in the fall, the heavy growth decays rapidly, and there is grave danger from fire during the winter months. The winter mulch offers acceptable quarters for field mice and rabbits. On the other hand, it is an excellent plant to prevent erosion of orchard soils. It resists itself and until the excessive growth is sufficient to smother the very young plants one seedling may be sufficient for years. The rapid accumulation of nitrogen and its effect upon the trees after the second year soon outweighs the tax of the clover upon the water supply when the trees were younger. The extremely matted growth prevents the growth of crab grass and summer weeds.

From the results of this experiment it is concluded that "Japan clover should be grown for two years prior to the setting of an apple orchard upon the orange-sand lands of west Tennessee. The crop of the second year should be turned under in September and well worked into the soil prior to the setting out of the orchard in December or later. For two years succeeding, crimson clover sown in August should be grown as winter and spring cover, and the ground cultivated from May until August. For two years succeeding, and longer, Japan clover may be grown, until the shade of the large trees prevents profitable growth."

Everbearing strawberries, G. M. DARROW (*U. S. Dept. Agr., Farmers' Bul. 901 (1917), pp. 19, figs. 7*).—This publication deals with the special cultural practices that have been developed in the production of varieties of strawberries that fruit during the summer and autumn. Introductory considerations deal with the desirability of everbearing sorts of strawberries, origin, and characteristics and adaptation. Information is then given relative to soils, fertilizers, time of planting, planting systems, distance of planting, removing blossoms and runners, tillage, mulching, duration of a plantation, harvesting, yields, and varieties.

Currant growing an important, promising industry for California, G. C. HUSMANN (*Cal. Fruit News, 57 (1918), No. 1542, p. 1*).—As a result of viticultural investigations conducted by the U. S. Department of Agriculture for a number of years the chief difficulties that have previously prevented the successful culture of the dark-colored commercial currants in California have been overcome.

It is necessary that the vines be grafted on resistant stocks congenial to them and suited to the soil and other conditions in which grown. Congenial and resistant stocks have been found for important soil types in the grape districts. It is also necessary to incise or decorticate the vines when they are in bloom to produce a full setting and maturing of the fruit, and to produce fruit of the

best quality. In making the incision, a ring of bark is removed from either the trunks, arms, or canes of the vines.

The department is studying further cultural details. Only one variety of currant, the Panariti, is recommended for planting. Other dark-colored varieties hitherto tried in California have proved worthless.

Raspberry culture. G. M. DARROW (*U. S. Dept. Agr., Farmers' Bul.* 887 (1917), pp. 44, figs. 33).—A treatise on raspberry culture based on practices which have proved highly successful in different sections. The author discusses the types of raspberries, extent and distribution of raspberry growing, location of a plantation, site of a plantation, preparing the land, planting, moisture supply in the soil, intercropping, tillage, maintenance of fertility, systems of training and pruning, winter protection, duration of a plantation, harvesting, yields, diseases and insects, propagation, varieties, and uses.

Indian tea: Its culture and manufacture. C. BALD (*Calcutta: Thacker, Spink & Co.* 1917, 3. ed., pp. 373, pls. 27, figs. 9).—The present edition of this work (*E. S. R.*, 21, p. 335) has been revised, partially rewritten, and somewhat enlarged.

Notes on the production and commerce of cacao. M. CALMON DU PIN E ALMEIDA (*Notas Acerca da Produção e Commercio do Cacao. Rio de Janeiro: Soc. Nac. Agr.*, 1917, pp. 21; *Jor. Com.* [Rio de Janeiro], 91 (1917), No. 160, pp. 3, 4).—A statistical account of the world's cacao industry, including data on production, consumption, import taxes, etc., in different countries.

The date palm in Egypt. T. W. BROWN (*Agr. Jour. Egypt*, 5 (1915), No. 1-2, pp. 63-79, pl. 1; 6 (1916), pp. 18-38, pls. 6).—Part 1 of this article discusses the methods of propagating the date palm, planting, and subsequent care, including methods of pollinating the female trees; part 2 treats in detail of the various kinds of dates grown and their relative commercial importance.

South American markets for dried fruits. W. FISCHER (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser.*, No. 148 (1917), pp. 35).—This is a short survey of the dried-fruit trade in South America, based on data gathered and observations made during the season 1915-16 in connection with an investigation of the fresh-fruit markets of that continent (*E. S. R.*, 37, p. 345). The present report discusses the purchasing power and the customs, tastes, and needs of the people, the current high prices, and the sources from which dried fruits are obtained, as factors determining the total consumption and the small share supplied by the United States. There are supplementary sections on California fruits in South America and on methods of distribution.

FORESTRY.

Incidental results of a study of Douglas fir seed in the Pacific Northwest. J. P. WILLIS (*Jour. Forestry*, 15 (1917), No. 8, pp. 991-1002).—In connection with the collection and drying of cones for a study of Douglas fir seed during the fall of 1912 a number of incidental experiments were conducted and are here discussed.

With reference to the proper time to collect cones, it was found that a considerable amount of good seed may be procured from cones entirely green in color, although the largest quantity of good seed is not obtained by this procedure. It seems satisfactory to collect cones when they first begin to assume a brownish hue. Actual tests indicate that in picking cones it is wise to take from a given tree only the larger, better developed cones. Large cones produce large seed and small cones small seed. The large seed was found to have a much higher germination percentage.

Studies were made relative to the best temperature for cone drying in a kiln. The results in general indicate that drying is the complex result of temperature, humidity, and air circulation. A relatively low temperature (even 130° F.) may be fatal to seed if the cones are green or the atmospheric humidity high. A similar temperature may be dangerous if any of the seed happens to be much exposed during treatment, and specially so if the humidity is low. With green cones, which are not well adapted to kiln treatment, a uniform temperature of over 100° is apt to cause great loss, largely through the superheating of the seed. Cones moderately dry can be exposed to temperature as high as 140°. It is suggested, however, that in view of the danger of excessive drying the temperature should be as low as is compatible with economy.

Seed that does not shake out readily from partially opened cones was found to be usually of high quality and worth saving, unless extra shaking is for some reason too expensive. The seeds last shaken out are apparently no smaller than those which are first extracted. The germination percentage is sometimes slightly low with the seed last obtained.

Methods of hastening germination, S. B. SNOW (*Jour. Forestry*, 15 (1917), No. 8, pp. 1003-1006).—In the spring of 1913 tests were made by the Feather River Experiment Station, near Quincy, Cal., of a number of different methods of hastening the germination of tree seed. The results of tests conducted with seed of sugar pine, western yellow pine, Jeffrey pine, and incense cedar are here presented in tabular form. The data as a whole were not conclusive but indicate, however, that soaking in solutions of sulphuric acid gives the best results for sugar pine seed.

Osmotic pressure as an index of habitat, B. MOORE (*Jour. Forestry*, 15 (1917), No. 8, pp. 1010-1013).—The author reviews recent investigations relative to the freezing-point depression and osmotic pressure of plant tissues in relation to environment, and calls attention to their direct bearing on forest research in that they reveal the existence of an index of habitat which may be of great value in silvical studies.

The farmer's woodlot, J. J. CRUMLEY (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 11, pp. 375-380, figs. 2).—This paper discusses the present condition of small woodlots in the more level sections of Ohio, with special reference to the detrimental effects of pasturing woodlots.

Advice to forest planters in the plains region, S. D. SMITH (*U. S. Dept. Agr., Farmers' Bul.* 888 (1917), pp. 23).—This publication gives advice about tree planting in the plains region to provide windbreaks, supplies of firewood, fence posts, and wood for repairs. A descriptive list is given of trees adapted to the northern and southern plains region, together with a discussion of mixed plantations, ornamental plantings, the details, methods, and time of planting, spacing, cultivation, thinning, pruning, protection, and where to secure trees and seeds. The publication concludes with a general list of "don'ts" for tree planters.

Planting experiments on the sand dunes of the Oregon coast, T. T. MUNGER (*Jour. Forestry*, 15 (1917), No. 8, pp. 1007-1009).—A brief statement of tree planting work conducted during the period 1910 to 1916. The experiments have been discontinued for the present because it appears that afforestation, except of the very best of the sand waste country, will not be possible until a herbaceous cover has first been established to stop the sand movement.

Axton plantations, B. E. FEBROW (*Jour. Forestry*, 15 (1917), No. 8, pp. 988-990).—With a view to furnishing a record for future reference, the author here presents a memorandum of the silvicultural work done by the former New York

State College of Forestry at Axton, N. Y. The present condition of the different forest plantations is also briefly noted.

Report of the director of forestry for the year 1916, R. H. CAMPBELL ET AL. (*Rept. Int. Canada, Rpt. Dir. Forestry (1916)*, pp. 95, figs. 26).—The report includes a review of the several lines of work conducted by the forestry branch during the year and detailed reports of the work of the tree-planting division and on the forest reserves in the separate Provinces, together with the report of the Forest Products Laboratory of Canada.

[**Report on**] **forestry** (*Ann. Rpt. Reforms and Prog. Chosen (Korea) (1915-16)*, pp. 129-134, pl. I).—A progress report on forest activities in Chosen during the year ended March 31, 1916, discussing forest protection, forest surveys, experimental afforestation, nursery work, and Arbor Day planting. Since April 3, 1911, the first Arbor Day, some 56,200,000 trees have been planted, especially by school children.

State ownership of forest lands, P. T. COOLIDGE (*Jour. Forestry*, 15 (1917), No. 8, pp. 951-973).—A discussion of State ownership of forest lands as a governmental policy.

Instructions for making timber surveys in the National Forests, including standard classification of forest types (*U. S. Dept. Agr., Forest Serv. (1917)*, pp. 53).—The purpose of this handbook is to present the policy of the Forest Service for the conduct of timber surveys and to standardize the methods used in the districts to the extent necessary to insure reasonably accurate and uniform results.

Alnus oregona: Its value as a forest type on the Siuslaw National Forest, H. M. JOHNSON (*Jour. Forestry*, 15 (1917), No. 8, pp. 981-987).—A discussion of the red alder (*A. oregona*) with reference to its silvical characteristics and value as a nurse crop for Douglas fir, as a soil builder, for fire protection to second growth and reproduction, and its commercial value.

Rubber cultivation in Trinidad and Tobago, N. LAMONT ET AL. (*Bul. Dept. Agr. Trinidad and Tobago*, 16 (1917), No. 3, pp. 95-127).—A report of a special committee of the Trinidad Board of Agriculture relative to the present status and future prospects of rubber cultivation in Trinidad and Tobago, including suggestions relative to cultural practices and the development of efficient tapping methods and uniform plantation methods of preparing rubber.

Rubber culture in the Philippines, P. J. WESTER (*Philippine Agr. Rev. [English Ed.]*, 10 (1917), No. 3, pp. 201-220, pls. 4, figs. 2).—The author reviews the present status of the plantation rubber industry, discusses the Philippines as a possible future source of rubber, and gives directions for the culture, harvesting, and preparation of Para rubber.

DISEASES OF PLANTS.

Problems of plant pathology, F. L. STEVENS (*Bot. Gaz.*, 63 (1917), No. 4, pp. 297-306).—This paper, dealing mainly with plant pathology as primarily an economic subject and referring also to the relations between science and pathological practice, offers suggestions regarding the classification of fungus plant diseases.

The dissemination of parasitic fungi and international legislation, E. J. BUTLER (*Mem. Dept. Agr. India, Bot. Ser.*, 9 (1917), No. 1, pp. 73).—This paper has for its primary object a discussion of the means by which parasites are able to cross oceans or tracts having only plants unsuitable to their spread. The principal means include birds, air movements, and commercial transportation of products. Control of the dissemination of diseases is discussed according to the cases in which the disease has already succeeded in gaining a foothold in

the country, those in which it has reached neighboring countries only, and those in which it is still confined to areas isolated by the ocean or large tracts with climate and vegetation unfavorable to the spread of the disease organisms.

As illustrative of the probable means of introduction of foreign species, the rusts of Australia are taken, some 27 of which are treated as introduced species and are discussed in connection with their hosts and several modes of introduction. The work of the International Phytopathological Convention held in Rome in 1914 is discussed in this connection.

Report of the botanist, S. M. BARN (*Tennessee Sta. Rpt. 1915, pp. 118-129*).—A summary report is given of investigations carried on by the department of botany on the selection of pear and apple seed for blight resistance, the physiology of the resistance of clover to *Colletotrichum*, and the resistance of *Spirogyra* to various fungi. The work with the pear and apple has only been begun, extensive plantings of seed from different sources having been made.

In the studies of clover resistance the maximum temperature endured by *Colletotrichum* spores was found to be about 45° C. (113° F.), the spores being killed by a moment's exposure to that temperature. This is believed to explain why so many samples of spores taken in the field during the season fail to germinate. Preliminary experiments indicate that infection of clover occurs much more readily in tissues in an actively growing or meristematic condition.

Experiments with *Spirogyra* are reported upon, *Spirogyra* having been selected as a convenient host plant for microscopical study. Three or four different fungus diseases of *Spirogyra* have been found and studied to some extent, the fungi being obligate parasites, facultative parasites, and saprophytes. The results of a microscopical study of the methods of attack showed that *Pythium* infects by zoospores, large numbers of which collect on *Spirogyra* cells that have just died. They do not collect upon living cells or upon cells long dead. Infection always starts at a dead cell. The advancement of the mycelium through the *Spirogyra* filament is said to take place with great rapidity as many as seven cells having been killed in an hour by a single filament of *Saprolegnia*.

[**Plant diseases in Barbados**], J. S. DASH (*Rpt. Dept. Agr. Barbados, 1915-16, pp. 35-40*).—The most notable sugar cane trouble observed during this period was that known as the pineapple disease (*Thielaviopsis paradoxa* (L. ethacetica)). No connection was established between this fungus and *Melanconium sacchari*, the cause of rind disease. *Colletotrichum falcatum* was not present to any considerable extent.

Examination of a new disease of sugar cane showed that the last-named fungus was often present with a *Cephalosporium*, which was studied and is herein discussed at some length. The disease does not seem to attack cane growing under very favorable conditions. Its progress is slow. Destruction of rotten canes and selection of plant material are expected to control the disease.

Cotton suffered severely only from leaf spots and mildew during this period. A branch disease of pigeon pea is ascribed to a *Colletotrichum*. Examination of dying sorrel plants showed a species of *Gloeosporium*, and a second species was found to cause a dieback and leaf cast in a single breadfruit tree.

Plant protection in Switzerland, F. G. STREBLER, A. VOLKART, and A. GRISER (*Schweiz. Samen Untersuch. u. Versuchsanst. Dettikon-Zürich, Jahresber., 5: (1915-16), pp. 23-28*).—This portion of the report deals briefly with diseases of cereal crops, potatoes, beets, legumes, and forage plants, also with nematode attack and weed pests.

[**Plant diseases in India**], J. MACKENNA (*Rpt. Prog. Agr. India, 1915-16, pp. 46-50*).—It is stated that the most important disease under investigation at

pest during the year 1915-16 was that of rice known as *ufra* in eastern Bengal. The cause of this very destructive disease is a nematode (*Tylenchus* sp.) which hibernates in dry stubble, renewing its activity with high atmospheric humidity and heavy rainfall and perishing after immersion for a few weeks in water or passing into a dormant state under dry conditions.

Trichospora, a parasitic species of *Orobancha* on tobacco, mustard, and cabbage, is now controlled by the use of sodium nitrate. A study of *Rhizoctonia* by E. S. R., 35, p. 148) has been continued. Studies have been prosecuted on two local plantain diseases and the black thread disease of rubber. Other diseases under investigation are a disease of sal trees; wilts of cotton, sesamum, jute, and chillies; and sclerotial diseases of jute and sugar cane.

A new method of dealing with the palmyra palm disease has proved effective. It consists of very close scrutiny of all palms in a disease center and cutting out and burning all diseased portions of the crown of affected trees. The palmyra disease of the areca palm can be eradicated from isolated areas by means of spraying.

Black rot of coffee is checked by Bordeaux mixture, which also controls blight of tea. Of the four smuts of sorghum present in Bombay, two can be prevented by steeping the seed in copper sulphate. Studies have been continued on fungi attacking tea roots and leaves. Poppy blight is epidemic only under adverse climatic conditions and poor drainage. Certain varieties appear to be almost immune to the disease.

Cryptogamic review for 1914 and report on leaf diseases of conifers, G. BRIOST (*Bol. Min. Agr. e Indus., Com. ed Lavoro* [Rome], Ser. B, 14 (1915), II, No. 1-2, pp. 38-47; *Atti Ist. Bot. R. Univ. Pavia*, 2, ser., 16 (1916), pp. 285-300).—This report, which is on the same general plan as that for 1913 (E. S. R., 34, p. 539) gives an account of diseases of conifers, vines, cereals, fruits, forage, garden, ornamental, industrial, and other plants; scientific and miscellaneous studies; and some publications of recent issue.

Cryptogamic review for 1915 with report on grain diseases, G. BRIOST (*Bol. Min. Agr. e Indus., Com. ed Lavoro* [Rome], Ser. B, 15 (1916), II, No. 5-8, pp. 1-26; *abs. in Riv. Patol. Veg.*, 8 (1916), No. 10, pp. 197, 198).—This report, which is on the same plan as that noted above, gives more particular attention to grain diseases.

Physoderma disease caused by *P. zea maydis* (U. S. Dept. Agr., Bur. Plant Industry, Plant Disease Bul., 1917, Nos. 1, pp. 9, 10; 3, pp. 51, 52, fig. 1).—A brief account is given of the occurrence and geographic distribution in the United States of *P. zea maydis*, which attacks corn. Its known distribution includes the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee.

The internal disease of cotton bolls, W. NOWELL (*Agr. News* [Barbados], 14 (1915), No. 344, p. 222; 345, pp. 238, 239).—The investigation of internal boll diseases of cotton having reached a stage where it is considered as likely that future research must follow entomological as well as mycological lines, the author summarizes the history of this disease and opinions regarding its causation, citing more particularly the findings and views of Robson (E. S. R., 35, p. 44) in this connection.

The general conclusion is that while the staining may be initiated by matter issuing from punctures in the young seeds it is caused by infection with a foreign organism. In most cases this appears to be a specific fungus (not yet named), but infection is in some cases due to other fungi or to bacteria.

The internal disease of cotton bolls, W. NOWELL (*Agr. News* [Barbados], 15 (1916), No. 364, pp. 126, 127).—Following up the information given in the

article above noted, the author states that in tests by Robson at Montserrat and Harland at St. Vincent, also by himself with material forwarded from both of these places, the disease was found to be due to the specific fungus mentioned in the article above noted. The facts indicate with apparent certainty the agency (as carriers) of plant-feeding green bugs (*Nezara viridula*). The fungus, which resembles closely *Eremothecium cymbalariae* and has considerable scientific interest owing to its methods of spore formation, has now been found in material from Tortola, St. Kitts, Montserrat, St. Vincent, and Barbados. It occurs in nearly all the bolls examined, but in a small proportion is replaced by bacteria.

The fungi of internal boll disease. W. NOWELL (*West Indian Bul.*, 16 (1917), No. 2, pp. 152-159, figs. 4).—The author here presents what is regarded as a preliminary outline of observations made on certain fungi, including one species closely resembling that described by Schneider (E. S. R., 36, p. 749), which occurs in green cotton bolls in the West Indies.

The fungus forms are four in number and are connected by certain features which strongly suggest a close interrelationship. It is thought that the facts here noted may prove to be of considerable importance in future discussions of the taxonomy of the simpler fungi.

It is regarded as proved that the gross staining of lint in unopened bolls (often followed by more or less rotting of the boll contents), which constitutes this disease, is due to infection resulting from the puncturing of the wall of the boll by plant bugs, mainly *Nezara viridula* and *Dysdercus* spp. The infecting organism is, in most cases, one of the four fungi referred to above, though a portion of the infections can be ascribed to bacteria. The proportion of such bacterial infections, though ordinarily small, increases greatly in wet weather.

Infections by the fungi may occur, apparently, at any developmental stage after the establishment of the boll, the effect varying accordingly in ways which are described.

Blight disease of potatoes. B. F. LUTMAN (*Ann. Rpt. Vt. State Hort. Soc.*, 13 (1916), pp. 55-60, pl. 1).—This is a discussion of the development of late blight of potato as it occurs in Vermont, the contributing causes, and the outlook for the near future in that State, with recommendations for its control. These include avoidance of diseased tubers for use as seed and spraying with Bordeaux mixture, beginning about the first week in July and continuing as found necessary.

Sugar cane diseases. R. AVERNA SACCA (*Bol. Agr. [Sao Paulo]*, 17, ser. No. 12 (1916), pp. 936-938).—Further mention is made of some diseases of sugar cane, as noted previously (E. S. R., 37, p. 553), along with a discussion of a mild injury due to *Capnodium* sp. on the stalks in damp situations, and of a severe injury due to a *Tylenchus* showing analogies to *T. acutocaudatus* together with remedial measures suggested.

Bitter pit investigation. The cause and control of bitter pit, with the results of experimental investigation, D. MCALPINE (*Rpt. Bitter Pit Invest. [Aust.]*, 5 (1915-16), pp. 144, pls. 38).—This, the fifth report on bitter pit (E. S. R., 37, p. 455), deals in some detail with yield in relation to bitter pit; crinkle, a confluent form of the trouble; diseases superficially resembling bitter pit; the fruit buds of the apple tree; pruning experiments; the effects of ringing and constricting the branches of apple and pear; experiments conducted under natural conditions with a view to controlling the trouble; the cause of bitter pit; and its control as regards orchard practice, storing, and shipping. It is now considered possible to ship fruit oversea without risk of overripening, and bitter pit may also be considerably reduced.

Many environmental factors contribute to the production of bitter pit. The primary cause, however, is unqualifiedly stated to be the pressure of sap in the outermost layer of pulp cells, which causes them to burst and also ruptures the associated vascular network. This pressure is thus too great for the constitutionally weakened tissue of the cultivated apple. The falling in of the skin is due to a deficiency in its nourishment and to the collapse of the underlying cells. The browning of the tissue originates immediately beneath the skin, but its extension along the conducting vessels may streak the flesh of the apple. There may be also an internal browning not noticeable at the surface. Bitter pit on the tree or in storage develops only in apples approaching maturity, never after its attainment. The pitting is generally confined to the calyx end of the fruit. There are both discrete and confluent forms of pitting.

In the manurial experiments in Victoria, the smallest amount of pitting occurred when bone dust was added to a complete fertilizer, high yield showing but little effect on the disease. In New South Wales the highest yield was associated with the least pitting, which was less than 0.5 per cent, but in South Australia this condition was reversed. In Western Australia the least pitting occurred where 1 lb. of iron sulphate was applied to each tree. Here also fertilizers tended to increase pitting, but the opposite result appeared in New South Wales, South Australia, and Victoria. Excess of nitrogenous manures tends to produce pitting on account of the rapid growth, accumulation of nutritive substances, and imperfect cell development.

Pruning is one of the most important means of control and has received special attention. The best results have been obtained by leader or light pruning. Whatever favors the regulation of the sap and its proportional distribution to the various fruit buds, so that each is well supplied but not gorged, also tends to reduce or prevent bitter pit. In a susceptible variety, such as Cleopatra, pitting has been reduced to from 4 to 6 per cent by pruning. Storage at 30 to 32° F. arrests or retards both bitter pit and overripening, as the apple while at this temperature is in a state described as a sort of suspended animation.

Bitter pit: Its cause and control. Experiments in pruning, manuring, irrigation, cool storing, D. McALPINE (*Fruit World Austral.*, 18 (1917), No. 4, pp. 2-6, 99, 103, figs. 3).—This is a brief account of the report above noted.

Effect of temperature, aeration, and humidity on Jonathan spot and scald of apples in storage, C. BROOKS and J. S. COOLEY (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 7, pp. 287-318, pls. 2, figs. 23).—A report is given of a study of Jonathan spot and scald of apples in relation to rot infection and the modifying effects of storage conditions and maturity of fruit. Both of the troubles are said to be important, not only because of their damaging effect on the appearance of the fruit, but also because of the part they play in paving the way for the entrance of various rot-producing fungi.

These diseases are said to show many similarities. The initial stages of both are found to be confined to the color-bearing cells of the skin; both render the apple susceptible to rot infections; both are decreased by good aeration and a fair degree of maturity of the fruit; and both are increased by a rise in temperature, having an optimum of about 20° C. and a maximum of about 30°.

The authors consider that apple scald is due to abnormal respiratory conditions resulting from poor aeration. Attention is called to the important rôle which aeration plays in the prevention of apple scald, as may be observed from the small amount of this disease in cellar and air-cooled storage.

Fire blight infection, H. A. GOSSARD and R. C. WALTON (*Mo. Bul. Ohio Sta.*, 1 (1917), No. 11, pp. 357-364, figs. 5).—The results are given of an investigation

begun in 1915, in which individual flower clusters, branches, and considerable portions of trees were protected in various ways from insects and from rain.

It was found that a considerable portion of the branches showed infection when protected against the entrance of insects but not protected against rain. Where a tree was protected both from rain drip and from insects, no blight infection occurred. Branches covered with four cheesecloth bags, above which, on the same tree, were artificially inoculated blossoms, showed heavy infection. Other data are presented which indicate that rain acts as a carrier of fire blight bacteria.

Citrus blast, a new bacterial disease. R. W. HOBSON (*Mo.-Bul. Com. Hort. Cal.*, 6 (1917), No. 6, pp. 229-233, figs. 2).—The author gives a brief account of his own work and that of Lee, as previously noted (E. S. R., 37, pp. 153, 154), on the disease of citrus due to *Bacterium citrefaciens*. Careful pruning is regarded as the most hopeful means of control at the present time.

[Diseases, injuries, and abnormalities of coconut in the Dutch East Indies.] P. E. KRECHENIUS (*Teysmannia*, 27 (1917), No. 11-12, pp. 624-635).—It is stated that diseases of coconut have not yet assumed very great importance in the Archipelago. Diseases with their causal organisms named in this connection include a leaf spot (*Pestalozzia palmarum*), a fungus bud rot (*Pythium palmirorum*), a bacterial bud rot (*Bacillus coli*), a stem bleeding disease (*Thielaviopsis thaeccius*) reported previously by Petch (E. S. R., 23, p. 625), and a root rot attributed to a *Diplodia*. Other phases of abnormality or injury include gummosis, fruit deformity, and the effects of lightning.

Fungus blights of tea in northeast India during the season 1915. A. C. TUNSTALL (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, No. 2 (1916), pp. 73-76).—This account names as tea leaf diseases in 1915 blister blight (*Erobatidium vexans*), copper blight (*Lastadia camelliae*), gray blight (*Pestalozzia* sp.), brown blight (*Colletotrichum camelliae*), rim blight (*Cladosporium* sp.), and red rust (*Cephalocurcus virescens*); as stem diseases, thread blight (sterile mycelium, probably a *Corticium*) and velvet blight; and as root parasites, *Hymenochaete noxia*, *Ustilina zonata*, *Rosellinia* spp., *Thyridaria tarda*, and *Fomes lucidus*.

Black rot disease of tea. T. PETCH (*Dept. Agr. Ceylon Leaflet* 2 (1917), pp. 3, fig. 1; *Trop. Agr. [Ceylon]*, 48 (1917), No. 3, pp. 156-158, fig. 1).—An account is given of a new disease of tea recently appearing in two districts in the low country. It is characterized by the blackening and fall of the younger leaves, which often remain attached to each other or to the stems (which are also attacked) by the mycelium of the fungus, which is said to be an *Hypochnus*. The spots on the older leaves and the corky warts on the young stems are not so characteristic.

The disease occurs in patches scattered over the field, suggesting spore distribution by the wind. The fungus is thought to come from any of several species of jungle plants, though spores have not as yet been observed, nor has the mycelium (though present on old leaves) been found on the blackened young leaves. The disease is named black rot from its analogies to a disease of coffee of the same name in southern India due to an *Hypochnus*, but possibly a different species from the one here considered. This fungus is found to remain alive for at least two months on prunings left in the field, or to fill with mycelium closed glass dishes containing infected dead leaves, the mycelium producing readily new infection on fresh leaves subsequently introduced.

Bordeaux mixture is recommended as a means for the control of this disease.

Brown blight of tea. W. McRAE and R. D. ANSTEAD (*Planters' Chron.*, 11 (1916), No. 1, pp. 2-4; *abs. in Internat. Inst. Agr. [Rome], Internat. Rer. Sci.*

and *Pract. Agr.*, 7 (1916), No. 5, pp. 757, 758).—Brown blight (*Colletotrichum camelliae*) is noted as having caused damage in some localities which are named. The disease is described and directions are given for its control. The author recommends, for the nurseries, removal of affected leaves, spraying with Bordeaux mixture, application of slaked lime to beds, freer admission of light and air to the nurseries, and careful watering when any is necessary; for older plants, modifications of these measures with avoidance of manures tending to produce sappy wood and heavy foliage and the use of those tending to produce harder wood.

[Mycological notes], A. C. TUNSTALL (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, No. 2 (1916), pp. 82-86).—The author recommends the substitution, for the lever or directly acting spray pumps now in common use, of a wheel and eccentric action to economize labor and equalize wear on the machinery, also of a nozzle capable of producing a very fine but abundant spray close up to the nozzle. The nozzle should be replaceable, owing to the rapid wear to which it is subjected, and to minimize this the use of glass nozzles is suggested. The apparatus should be very simple, durable, and easy of operation to minimize the bad effects of unskilled handling.

Rim blight was noticeable on severely pruned tea plants. It was less noticeable on those which had been sprayed with caustic washes used to relieve a barkbound condition. It is thought best to employ this early in the cold season to avoid giving the tea a setback. Bordeaux mixture applied in March or April is considered more suitable for healthy and vigorous plants.

Basic problems in forest pathology, E. P. MEINECKE (*Jour. Forestry*, 15 (1917), No. 2, pp. 215-224).—The great problems of forest pathology now demanding attention in this country are designated as those of silviculture during the necessary period of transition from virgin forests (still almost universal in the United States) to regulated forests (as now prevalent in Europe). The author emphasizes the need of shaping and carrying out policies for minimizing as much as possible the cumulative losses from various agencies, as previously noted (E. S. R., 35, p. 43).

Polyporus schweinitzii, J. M. MURRAY (*Trans. Roy. Scot. Arbor. Soc.*, 30 (1916), pt. 1, pp. 56, 57, pl. 1; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 5, p. 759).—It is stated that *P. schweinitzii*, long known to attack (but not very severely) a number of conifers in Europe and to be destructive in the northern forests of spruce and fir in the United States, but hitherto considered as rare in the British Isles, is supposed to be increasing there so as to threaten the coniferous forests. Several species have now been attacked by it in this region. The appearance, development, and effects of the fungus are described. Protective measures suggested include cutting off affected roots beyond all signs of rot, tarring the wounds thus made, collection and destruction of young sporophores, and the replacement of badly attacked conifers with hardwood trees.

White pine blister rust disease, A. F. HAWES (*Ann. Rpt. State Forester Vt.*, 5 (1916), pp. 22-26).—A very brief account is given regarding the history of the white pine blister rust (*Cronartium ribicola*) in this country, the control measures attempted therewith, and the general results therefrom, also regarding inspection work done in Vermont between May 15 and July 1, 1915, the results of which are presented in tabular form.

Diagnosing white pine blister rust from its mycelium, R. H. COLLEY (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 6, pp. 281-286, pl. 1, fig. 1).—According to the author, by the use of safranin and lichtgruen, it is possible to

stain the mycelium of *Cronartium ribicola* and the cells of the host so that the mycelium may be distinguished from that of other fungi parasitic on white pine bark. The manner in which the parasite attacks the host cells is said to be very characteristic, in that the cells remain alive for a long time when attacked by the blister rust fungus, the hyphae run between the cells, the bark swells, turns a yellowish-green color, and does not crack until the aecia are produced. The presence in the bark of *Pinus strobus* of mycelium showing these phenomena is considered sufficient evidence to warrant the conclusion that the pine is infected with *C. ribicola*.

The leaf disease of rubber. Conditions in Surinam, C. K. BANCROFT (*Jour. Bd. Agr. Brit. Guiana*, 10 (1917), No. 2, pp. 93-103).—An account is given of the results of inspection of Hevea, coffee, and cacao plantings in Surinam and of examinations at the botanic station at Paramaribo.

The leaf disease first appeared in Dutch and British Guiana about 1907, assumed epidemic form on some plantations in 1914, and at the time of this report existed on every estate in Surinam growing Hevea. It affects trees of all ages and shows no sign of diminution locally, though indications at some of the places are more hopeful. The causal organism, which has been named in different localities *Fusicladium macrosporum*, *Passalora hevea*, and *Microstroma hevea*, is said to be native to Peru, Brazil, Dutch Guiana, British Guiana, and probably Trinidad, occurring in these countries on wild trees of *H. brasiliensis*, *H. guyanensis*, and *H. confusa*. A brief discussion is given of the fungus, its life history, and remedial measures, including destruction of wild Heveas near the plantations and removal of all infected leaves. Defoliation by smoke as a remedial measure is also discussed.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Rodent destruction on ships, R. H. CREEL (*Pub. Health Rpts. [U. S.]*, 32 (1917), No. 36, pp. 1445-1450).—A report on the relative efficiency of fumigants as determined by subsequent intensive trapping over a period of one year.

In the fumigation work sulphur dioxide was used on 62 vessels and hydrocyanic acid gas on 182 vessels. The latter resulted in the destruction of 95 of each possible 100 rodents, and the former destroying 77 per cent, notwithstanding the fact that the duration of exposure was 6 hours for holds and superstructures alike when sulphur was used, in contrast to 1½ hours for the holds and 30 minutes for the superstructures with hydrocyanic acid gas. Cyanid was used at the rate of 5 oz. to 1,000 cu. ft., and the sulphur in the proportion of 3 lbs. to 1,000 cu. ft. of space.

"Sulphur fumigation is not effective for the destruction of rats on loaded vessels or in superstructures. . . . Judging from the results of our observations it would appear that the fumigation of engine and fire rooms can, under ordinary conditions, be omitted, without materially reducing the effectiveness of the destruction of rodents on vessels. . . . In exceptional cases, such as demonstrable plague infection on board vessels, it is believed that the engine and fire rooms should be included in the procedure."

See also a previous note (E. S. R., 35, p. 53).

House rats and mice, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul.* 856 (1917), pp. 23, figs. 10).—A revised edition of Farmers' Bulletin 369, previously noted (E. S. R., 21, p. 751).

The game birds of West Virginia, E. A. BROOKS (*Bien. Rpt. Forest, Game, and Fish Warden, W. Va., 1915-16*, pp. 91-160, pls. 9).—In addition to descriptions of the species of game birds of West Virginia chapters are devoted to discussions of the forest conditions in the State as related to game birds.

hunting game birds, economic value of game birds, artificial and natural propagation, protection of game birds, and laws for the protection of game birds.

Intra-vitam color reactions, N. A. COBB (*Science*, n. ser., 46 (1917), No. 1181, pp. 167-169, figs. 2).—The author has met with considerable success in feeding coal-tar and other colored compounds to nematodes. They have not interfered materially with normal metabolism and the best results have been from the cumulative action, using small quantities of color dissolved in the medium in which the nematode lived and allowing the dye to act for days or weeks. "Not infrequently the dyes prove to be highly specific in their action, only certain cells, or only definite parts of certain cells, exhibit visible reactions in the form of colorations. . . . A dye may give rise to several different colors, none of them like that of the dye itself, and all of them very likely due to new compounds." Present efforts are being directed toward the discovery of dyes of greater or less permanency.

Sodium cyanid as a fumigant, G. M. BENTLEY (*Tenn. Bd. Ent. Bul.* 18 (1916), pp. 12, figs. 5).—Directions are given for the fumigation of nursery stock, including the construction of fumigating structures.

General treatise on entomology, T. MIYAKE (*Konchūgaku Hanron Jōkwan*, Tokyo: Shōkūhō, Nihonbashi, 1917; rev. in *Science*, n. ser., 46 (1917), No. 1179, pp. 113, 114).—This work, dealing with the morphology, physiology, and embryology of insects, comprises the first part of a handbook on entomology. The review is by L. O. Howard.

Benefits to be derived from observing, collecting, and studying insects, G. M. BENTLEY (*Tenn. Bd. Ent. Bul.* 20 (1917), pp. 32, figs. 22).—A popular account.

The relation of soil insects to climatic conditions, A. E. CAMERON (*Agr. Gaz. Canada*, 4 (1917), No. 8, pp. 663-669).—A general discussion of this subject.

How insects affect the cotton plant and means of combating them, W. D. PERRE (*U. S. Dept. Agr., Farmers' Bul.* 890 (1917), pp. 27, figs. 36).—This is a popular summary of information on cotton insects and means for their control.

Control of insect pests of sugar cane by fungi and bacteria, J. GROENEWEGE (*Arch. Suikerindus. Nederland. Indië*, 24 (1916), No. 51, pp. 2023-2033; *Meded. Proefstat. Java-Suikerindus.*, 6 (1916), No. 18, pp. 531-541; *abs. in Rev. Appl. Ent. Ser. A*, 5 (1917), No. 7, pp. 277, 278).—The economic importance attributed to the control of insect pests by fungus and bacterial diseases is questioned by the author.

Notes on insect pests of green manures and shade trees, E. A. ANDREWS (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, No. 3 (1915), pp. 57-62; No. 1 (1916), pp. 18-21).—A summary of information on the insects which are found to attack green manure crops and shade trees on tea estates in northeast India.

Report of associate entomologist, G. M. BENTLEY (*Tennessee Sta. Rpt.* 1914, pp. 252-284).—This consists of a brief statement of the work under way during 1914, of which mention may be made of that with the strawberry root lice (*Aphis forbesi* and *Macrosiphum fragariae*) which are rapidly becoming distributed over the State, one or the other infesting strawberry plants in 25 of the 96 counties. In several sections of the State the young are produced throughout the winter months, while in other sections the winter is passed in the egg stage. In control experiments the plowing under of infested plants and the selection of a field where strawberry plants have not recently been grown proved the most successful.

Report of the associate entomologist, G. M. BENTLEY (*Tennessee Sta. Rpt.* 1915, pp. 126-128).—A brief report is given of the work of the year with the more important insect pests, particularly aphidids.

The black peach aphid, which was very prevalent during the year, was found to be best controlled by the use of 40 per cent nicotin sulphate solution, reduced at the rate of 1 to 500, with 0.5 lb. laundry soap dissolved in each 3 gal. of the reduction. The rose chafer, which caused considerable injury to young peaches, eating from one-third to two-thirds of the fruit, was quite satisfactorily controlled by the use of 6 lbs. of arsenate of lead to 50 gal. of water sweetened with 1 gal. sorghum. The ash-gray blister beetle, which occurred in swarms in parts of east Tennessee, caused considerable loss to alfalfa, soy beans, and cowpeas. It was disseminated by cutting the crop at the time of the attack, there being no known case of a second infestation occurring in the same field.

In experiments at the station apiary it was found that bees in double-wall hives come through the winter much stronger than those in the single-wall hives and with 25 per cent less honey required to feed them.

Forty-seventh annual report of the Entomological Society of Ontario 1916 (*Ann. Rpt. Ent. Soc. Ontario*, 47 (1916), pp. 174, figs. 52).—Among the more important papers here presented are the following: Dusting Fruit Trees and Grapes for the Control of Diseases and Biting Insects, by L. Caesar (pp. 31-43); General Notes on Aphids which Occur on Apple Trees, by W. A. Ross (pp. 43-49); Note on *Physanota unipuncta*, by A. F. Winn (pp. 50, 51); Preliminary Notes on the Use of Repellents for Horn Flies and Stable Flies on Cattle, by A. W. Baker (pp. 52-56); The Relation of Insects to Disease in Man and Animals, by L. O. Howard (pp. 57-62); Insects as Material for Studies in Heredity, by W. Lochhead (pp. 66-72); An Historical Account of the Forest Tent Caterpillar and of the Fall Webworm in North America, by A. B. Baird (pp. 73-87); Camp Hygiene, by G. J. Spencer (pp. 87-89); The Experimental Results in Apple Maggot Control, by W. H. Brittain (pp. 89-91); Experiments on the Control of Locusts with *Coccobacillus acridiorum*, by E. M. DuPorte and J. Vanderleek (pp. 91-95) (*E. S. R.*, 37, p. 760); Some Features of Interest in Connection with Our Studies of Forest and Shade Tree Insects, by J. M. Swaine (pp. 95-106); Notes on Some Insects of the Season, by L. Caesar (pp. 106-110); Three Important Greenhouse Pests Recently Introduced into Canada, namely, the Florida fern caterpillar (*Callopietria floridensis*), the chrysanthemum midge (*Diarthronomyia hypogæa*), and the rose midge (*Dasyneura rhodophaga*), by A. Gibson (pp. 111-122); Experiments in the Control of the Poplar and Willow Borer (*Cryptorhynchus lapathi*), by R. Matheson (pp. 122-132) (*E. S. R.*, 37, p. 464); The Fruit Tree Leaf Roller in New York State, by G. W. Herrick (pp. 132-137); and the Entomological Record, 1916, by A. Gibson (pp. 137-171.)

Some injurious biting insects in Nova Scotia, A. G. DUSTAN (*Ann. Rpt. Fruit Growers' Assoc. Nova Scotia*, 53 (1917), pp. 61-67).—Brief notes are given on the brown-tail moth, which is said to be the most injurious pest in Nova Scotia; the dock sawfly (*Ametastegia glabrata*), first recognized as a serious pest in the winter of 1915-16; the leaf sewer (*Ancylis nubeculana*), widely distributed throughout the Province, which in one orchard during the previous season attacked 90 per cent of the leaves; the tussock moth, severe outbreaks of which occur once in every eight or ten years; and the cankerworm, which almost totally defoliated many orchards during 1915 and was even more injurious during 1916.

A year of Costa Rican natural history, AMELIA S. and P. P. CALVERT (*New York: The Macmillan Co.*, 1917, pp. XIX+577, pls. 82, figs. 7).—This work includes reports of observations on insects of economic importance.

The insect association of a local environmental complex in the district of Holmes Chapel, Cheshire, A. E. CAMERON (*Trans. Roy. Soc. Edinb.*, 52 (1917).

pt. 1, No. 2, pp. 37-78, pls. 2).—The subject is dealt with under the headings of physiography and topography, the plant environment and its relation to insects, physical factors of the environment, the insect association, and soil insect census.

[Insect pests of Madras] (*Madras Agr. Dept. Yearbook, 1917, pp. 76-99, pls. 2, fig. 1*).—Notes are included by T. V. Ramakrishna Ayyar on the life history and habits of the eye fly (*Siphonella funicola*) (pp. 76-83); a new pest of the coconut palm on the West Coast (*Contheyla rotunda*), which damages coconut trees in the Cochin State (pp. 91-96); and on the egg-laying habits of the agathi weevil (*Alicides budo*), which attacks agathi, cluster beans, and indigo in South India and also the betel vine (pp. 97-99). Notes on the life history of *Meqacalum stramineum*, a pest of *Andropogon sorghum*, by E. Ballard (pp. 83-87) and on *Adisura atkinsoni*, a pest of *Dolichos lablab* throughout the Madras Presidency, which also attacks red gram to a small extent, by Y. Raina-Chandra Rao (pp. 87-91), are also included.

Termites in the Luskerepore Valley, E. A. ANDREWS (*Indian Tea Assoc., Sci. Rept. Quart. Jour., No. 2 (1916), pp. 54-72, pls. 2, figs. 5*).—A report upon observations of the depredations of termites in the Luskerepore Valley of South Sylhet.

The life of the grasshopper, J. H. FABRE, trans. by A. TEIXEIRA DE MATTOS (*New York: Dodd, Mead & Co., 1917, pp. VIII+453*).—The translator here brings together the essays in the author's *Souvenirs Entomologiques* that treat of grasshoppers, crickets, locusts, the cicada, the mantis, the foamy cicadella, etc.

The sycamore lace-bug (*Corythucha ciliata*), O. WADE (*Oklahoma Sta. Bul. 116 (1917), pp. 16, figs. 7*).—The sycamore lace-bug here considered and the bagworm are about the only serious insect enemies of the western sycamore (*Platanus occidentalis*). This lace-bug is widely distributed throughout the United States, being the most common and probably the best known of the tinids. It appears to confine itself entirely to trees of the genus *Platanus*, being found throughout the range of the western sycamore. Observations made by the author in Oklahoma nurseries failed to show that it attacks the eastern plane tree (*P. orientalis*), though it is thought that the native species *P. erightii* of Arizona and New Mexico and *P. racemosa* of California serve as hosts.

The injury is caused by both the young and adults, which suck the sap from the under surface of the leaves, the foliage being left in a whitish, deadened state. In common with all members of the family this lace-bug hibernates in the adult stage, usually under the loose, rougher bark of the host tree. Oviposition commences in March, the eggs being deposited along the larger ribs of the leaves, singly or in groups of as many as ten. One female under observation which began March 18 had laid 284 eggs up to the time of her death on June 9. The eggs hatch in from 14 to 21 days, averaging 15 days under optimum conditions. The five nymphal instars were found to average 3, 3, 4, 5, and 5 days, respectively.

Technical descriptions are given of the several stages of the species and their distinguishing characteristics are pointed out.

Mention is made of several predatory enemies. A test made of several insecticides, including kerosene emulsion, fish-oil soap, and nicotin sulphate, showed that a fish-oil soap solution consisting of fish-oil soap 1 lb. to water 4 gal. is the most practical and effective, and when carefully applied with a good spraying apparatus it should be as cheap or cheaper than the other solutions tested.

The beet leaf-hopper and the curly leaf disease that it transmits, E. D. BALL (*Utah Sta. Bul. 155 (1917), pp. 3-56, figs. 32*).—This is a summary of the present status of knowledge of the beet leaf-hopper and the curly leaf disease, including the author's investigations, presented in connection with a bibliography of 20 titles.

It is pointed out that punctures of the beet leaf-hopper cause this specific disease of sugar beets and that it has never been produced except through the punctures of a beet leaf-hopper. The conclusion that it is transmitted by the beet leaf-hopper has been confirmed by several investigators. "If a single leaf-hopper is applied to a beet for five minutes, the curly leaf disease will appear after about two weeks, if conditions are favorable. Cold, wet weather will stop the development of further symptoms of curly leaf on a slightly diseased plant or prevent their development on a previously healthy one, even if a number of leaf-hoppers are kept thereon. . . . Leaf-hoppers taken from wild plants did not transmit the disease until they fed on diseased beets. Three hours on a beet rendered them pathogenic, but they could not transmit until after an incubation period of one or two days. It is probable that some wild plant carries the disease, and leaf-hoppers coming from this plant are able to transmit it to the beets.

"A large number of leaf-hoppers, early attack, hot weather, and clean cultivation are favorable to curly-leaf development. The converse of these factors, together with frequent cultivation, early irrigation, and shade or weeds are unfavorable. Seed growing is doubly hazardous in curly-leaf areas. Loss from curly leaf may be largely prevented by avoiding dangerous areas, by planting small acreages in a 'blight cycle,' by time of planting, by not thinning just as the leaf-hoppers appear, and by knowledge of conditions on breeding grounds. Parasites doubtless assist somewhat in controlling the leaf-hopper, but to be at all effective should be introduced into the permanent breeding grounds. The outlook for the immediate future in the intermountain and coast regions is favorable; for the plains region, doubtful; and for the Glendale, Tulare, and Columbia-Snake River region, serious."

Mango hopper control experiments, E. BALLARD (*Agr. Jour. India, 10 (1915), No. 4, pp. 395-398*).—*Idiocerus niveosparsus* is the cause of great annual loss to mango growers of Chittoor and Salem, a really severe attack resulting in the total loss of the crop and the greatly diminished vitality of the trees. Upon emerging from the egg the young hoppers feed at once upon the leaf or flower shoots. In a badly attacked mango grove the trees are covered with their honeydew, the flower shoots blacken and wither, and no fruit is set.

In control experiments fish-oil soap appeared to be superior to crude oil emulsion 1:10, and cheaper. The results of spraying experiments on 55 trees, presented in tabular form, indicate that spraying is profitable.

Mango hopper control, P. J. WESTER (*Philippine Agr. Rev. [English Ed.], 3 (1916), No. 2, pp. 159, 160; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 12, p. 1862*).—In briefly reviewing the article by Ballard above noted relating to the control of *Idiocerus niveosparsus* in India, the author calls attention to the fact that more or less damage is done annually to the mango crop in the Philippines by *I. niveosparsus* and *I. clypealis*. In some years in certain districts the entire crop is destroyed.

Insecticide spraying for the mango hopper, T. V. RAMAKRISHNA AYYAR (*Madras Agr. Calendar, 1917-18, pp. 72-74, figs. 2*).—A brief account is given of the control work of the previous year with the mango leaf hopper. Quite satisfactory results were obtained from the use (1) of crude oil emulsion and (2) of fish-oil rosin soap, both used at the rate of 1 lb. to 10 gal. of water. It

was found that at a cost of 8 annas (16 cts.) per tree the crop could be saved and clear profits made.

The mango hopper pest and its control, T. V. RAMAKRISHNA AYTAR (*Dept. Agr. Madras Leaflet 3* (1917), pp. 6, figs. 2).—A more detailed account than that noted above.

The present status of our knowledge of the homopterous fauna of Formosa, F. SCHUMACHER (*Mitt. Zool. Mus. Berlin*, 8 (1915), No. 1, pp. 71-134).—This paper lists 325 species of Homoptera from Formosa, of which 2 genera and 9 species are described as new to science. A bibliography of 38 titles relating to the subject is included.

Silk.—Replies from commissioners of customs to inspector general's circular No. 103, second series, to which is added Manchurian tussore silk (Shanghai, China: *Insp. Gen. Customs*, 1917, pp. VII+212, pls. 42).—This is a reprint of a report relating to the production and manufacture of silk in China, published in 1881, to which is added an extended account by N. Shaw of Manchurian tussore silk and a list of the books consulted (pp. 163-199). The paper by Shaw gives an account of the saturniid silkworm *Antheraea pernyi*, including descriptions of its several stages, life history and habits, and food plants, which consist of species of oak (*Quercus dentata*, *Q. aliena*, *Q. mongolica*, etc.), cultivation and care of trees, a detailed statement on rearing the worms, predaceous enemies, and diseases.

The other 23 varieties of silk-producing moths that occur in Manchuria are said to be quite unimportant commercially.

[Antler moth (*Choræas graminis*) infestation] (*Jour. Bd. Agr. [London]*, 24 (1917), No. 5, pp. 514-526, pl. 1).—A report on an infestation of larvæ of the antler moth (*C. graminis*) in the Peak District, by A. C. Cole and A. D. Innes (pp. 514-522), and an account of an invasion of the caterpillars of the antler moth into Yorkshire, by J. Snell (pp. 523-526), are given.

The codling moth in 1916, P. A. GLENN (*Trans. Ill. Hort. Soc., n. ser.*, 50 (1916), pp. 197-214, pls. 7).—This is a report of investigations carried on in continuation of those of the previous year (*E. S. R.*, 36, p. 853) at stations located at Ozark, Olney, Plainview, and Springfield, Ill. A large third generation was found to occur at all the stations and probably as far north as Dixon, though at that place it must have been too small to be of importance. The second generation at Olney was much larger in proportion to the first generation of 1916 than during the previous year. The third generation of 1916 was almost as large as the second.

Data relating to life history studies are accompanied by a diagram which graphically illustrates the seasonal history of the codling moth, an average daily temperature about 50° F., and the monthly rainfall at Olney in 1916, showing the dates when each of the three generations of pupæ, adults, eggs, and larvæ began and ended, and the relative number of individuals appearing each day. The mean monthly temperatures at Olney for the growing months of 1915 and 1916 and of a normal year are also charted.

By the use of the first of the two tables given it can be determined when larvæ of the first generation will be hatching out. This table gives the date of emergence of the moths and the dates when the first larvæ, maximum number of larvæ, and last larvæ from the eggs of these moths appeared in 1915 and 1916. By collecting 200 or 300 larvæ early in the spring, or better the preceding fall, and placing them in a cage in the orchard or yard so that they will be under the same conditions as to heat and moisture as those left on the trees, and by examining the cage daily after April 20, the date when the first moths emerge can be readily ascertained. Then by consulting the table the observer will find when the eggs

from the moths which emerged on that date hatched in 1915 and 1916 and will know approximately when to expect the first larvæ in his orchard.

In the second table are shown the dates when the larvæ of the first generation left the apple and the date when the first larvæ descending from them hatched out in 1915 and 1916. By banding a dozen or more trees not later than June 1 and examining the bands daily or at intervals of three or four days and consulting the table when larvæ are found, the fruit grower may be advised beforehand when and in what relative numbers the larvæ of the second generation will be hatching in the orchard long enough beforehand to protect the crop.

Syrphids of Maine.—II, Life history studies, C. L. METCALF (*Maine Sta. Bul.* 263 (1917), pp. 153-176, pls. 5).—In this continuation of the studies previously noted (*E. S. R.*, 36, p. 460) the author reports upon the biology and economic status of four additional species, all of which are aphidophagous. The species considered are *Xanthogramma divisa*, *Syrphus oronoensis* n. sp., *Platychirus perpallidus*, and *S. knabi*. *S. oronoensis* appears to be an important predator of aphids affecting stone fruits, *X. divisa* and *S. knabi* are, so far as observed, of more benefit to certain shade and forest trees, while the chosen food of *P. perpallidus* has not been determined. The latter species is of faunistic interest, since it has not hitherto been recorded outside of Great Britain. The author has also obtained several European species of *Platychirus* in Maine, namely, *P. scutatus*, *P. immarginatus*, *P. discimanus*, and *P. angustatus*.

Attention is called to the fact that *Platychirus* and *Xanthogramma*, previously recorded as having species which are scavengers in the larval stage, should be added to the list of ten genera given in the bulletin, previously noted, as aphidophagous, at least in part.

"El tórsalo" (*Dermatobia cyaniventris*), J. M. ARIAS G. (*El Tórsalo (Dermatobia cyaniventris)*. San Jose, Costa Rica: Dept. Agr., 1917, pp. 19, figs. 6).—An account of this oestrid, called "el tórsalo" by the author, the larvæ of which develop in the skin of man, in tropical America.

Studies upon the common house fly (*Musca domestica*), I, II, J. R. SCOTT (*Jour. Med. Research*, 37 (1917), No. 1, pp. 101-119, 121-124).—Two studies are reported.

I. *A general study of the bacteriology of the house fly in the District of Columbia.*—This is a detailed report upon the bacterial flora of house flies collected in various sections of the city of Washington.

"House flies show seasonal variation in the number of bacteria carried as well as in the species of bacteria. The seasonal variation shows the greatest bacterial flora is coincident with the summer months, and the occurrence of intestinal complaints of summer and early autumn. The isolation of members of the colon-typhoid-dysentery group of bacilli from numbers of flies indicates that the house fly has the power of carrying the closely allied pathogens, typhoid and dysentery. The finding of virulent pyogenic cocci indicates the possibility of the common house fly being a factor in the dissemination of the suppurative processes.

"The results of my experiments indicate that typhoid fever in the District of Columbia, under normal conditions, is not referable to the agency of the house fly."

II. *The isolation of B. cuniculicida, a hitherto unreported isolation.*—In the course of the investigations above noted, the causative organism (*Bacillus cuniculicida*) of a septicemia in rabbits and guinea pigs was obtained from two flies. This appears to be the first reported instance of its isolation from the house fly.

"This recovery of *B. cuniculicida* may indicate at least one manner in which the bacillus is carried to pens of healthy experimental animals, and demon-

states the necessity for proper screening of windows and doors of rooms where experimental animals are kept. It particularly indicates the necessity for keeping experimental animals inoculated with pathogenic organisms protected from the house fly."

Flies and bacillary enteritis, W. NICOLL (*Brit. Med. Jour.*, No. 2948 (1917), p. 870-872).—Continuing a discussion of flies in disease transmission (E. S. R., p. 854), the author shows that organisms producing bacillary enteritis are to be met with not infrequently in flies under natural conditions, that a considerable number of organisms resembling enteritis bacilli occur frequently in flies in the natural state, and that the utmost care is necessary in discriminating between these and the true enteritis-producing organisms.

A note on the rice field fly (*Ephydra macellaria*) (*Bul. Soc. Ent. Egypte*, 1916, No. 4, pp. 102-105).—The author is of the opinion that this fly, which is frequently accused by farmers of causing the death of rice over considerable areas in the northern part of Lower Egypt, is a secondary invader rather than the cause of the death of young rice. Its food appears to consist of dead and decaying vegetable matter and possibly living algae.

Fleas and their control, F. C. BISHOPP (*U. S. Dept. Agr., Farmers' Bul.* 897 (1917), pp. 15, figs. 6).—This is a revision of Farmers' Bulletin 683, previously issued (E. S. R., 34, p. 159).

Three-lined fig-tree borer, J. R. HORTON (*U. S. Dept. Agr., Jour. Agr. Res.*, 11 (1917), No. 8, pp. 371-382, pls. 3).—This is a report of studies made of *Ptychodes trilineatus*, a cerambycid which is the source of considerable injury to fig trees (*Ficus carica*) in the Southern States through boring into the larger branches and trunks. It is not, however, the only borer attacking fig trees in the Southern States, mention being made of *Leptostylus biustus*, *Goesia stephanoderes* sp., and *Ataxia crypta*, all of which were found working in the same trees with *P. trilineatus*.

This fig borer is known to occur throughout the Southern States from Florida to Houston, Tex., and from South Carolina to the Gulf. It has also been reported from parts of Mexico, several of the Central American countries, the West Indies, South America, and Tahiti.

The greatest amount of damage is caused by the larvæ, although the adult beetle causes some injury by feeding upon the fruit, leaves, and bark and by depositing in the bark. The larva mines its way into the larger branches and trunks of the tree where it feeds upon the wood for from three months to more than one year. The borers live in both dry and green wood but seem to prefer wood that is partly dead and has lost some of its sap. The favorite points of attack are near wounds made by the breaking of large limbs, untreated saw cuts, splitting of the trunk, the knots formed in the branches by fig canker, injuries in the bark, etc. The author finds that fig trees kept in a thriving healthy condition are less subject to severe attacks by this borer.

The eggs, which are deposited by insertion into the bark of the larger branches and trunk, hatch in from 3 to 8 days, with an average of 5.6 days. In hatching out the young borer mines its way along through the bark for several days, then tunnels into the solid wood, and often eats its way to the very heart of the branch. It lives and feeds in this manner for from 2 to 15 months. About two-thirds of the borers complete the larval stage in the season in which the eggs are deposited, while the remaining third live through the winter and pupate the following season. The single-season larvæ require approximately from 2 to 4.5 months to complete their larval life, and the overwintering borers from 7.5 to 15 months, with an average of 3 months, the average life in the wood being 11½ months.

There is a wide variation in the number of molts, a little more than half of those under observation having molted only 5 or 6 times, about one-fourth of them molting 8 times, and the remaining fourth, 4, 7, 9, and 10 times. It is pointed out that there is also a wide variation in the duration of the larval instars.

The duration of the pupal stage, which is passed entirely within the sawdust cell constructed by the borer in its tunnel in the wood, is also quite irregular, varying from 5 to 73 days, with an average of 24 days for the 70 specimens observed. The longevity of the adult varied for the 24 specimens observed from 75 to 222 days. It was found that a single female will deposit from 100 to 184 eggs in the course of its life, at an average rate of from 1 to 2.4 eggs per day.

It is pointed out that the most important control measure is that of keeping the trees in the healthiest condition possible. Trees of which the trunks are badly infested should be cut down and burned as it is practically impossible to save them and they will serve as a source of infestation and a menace to the healthy trees. In some cases the borers may be killed by injecting carbon disulphide into the tunnels and plugging the opening with putty, but this method is impractical where the infestation is severe and well advanced.

[Report on the banana borer in Mayumba], R. MAYNÉ (*Bul. Agr. Congo Belge*, 7 (1916), No. 3-4, pp. 236-239, fig. 1).—The curculionid *Cosmopolites sordida*, the larva of which bores in the trunk, has resulted in a great decrease in bananas in certain regions of Mayumba. Accounts of this pest in Fiji (Jepson (*E. S. R.*, 35, p. 57) and in Jamaica (*E. S. R.*, 37, p. 161) have been noted.

Injurious British weevils, H. BASTIN (*Jour. Bath and West and South Counties Soc.*, 5, ser., 11 (1916-17), pp. 56-81, pls. 8).—The author here brings together in small compass the known facts relative to the life histories of British weevils and notes on the various methods employed in their control.

Bees and their management, W. HERROD-HEMPSALL (*In Live Stock of the Farm*, London: The Gresham Pub. Co., 1916, vol. 6, pp. 1-63, pls. 3, figs. 13).—A summary of information on beekeeping.

The structure and life history of *Bracon* sp.: A study in parasitism, J. W. MUNRO (*Proc. Roy. Soc. Edinb.*, 36 (1915-16), No. 3-4, pp. 313-333, pls. 2).—This paper deals with an important braconid parasite of the brown pine weevil (*Hylobius abietis*), the worst insect pest of forestry in Scotland, which is thought to be *Bracon hylobii*. In laboratory work three broods were reared during the summer and no hyperparasites observed. The parasite has been found in nine counties of Scotland, showing a wide and probably general distribution and indicating that it is probably present wherever *H. abietis* occurs in numbers. A preliminary account has previously been noted (*E. S. R.*, 2, p. 852).

Italian entomological fauna.—Hymenoptera: Formicidae, C. EMERY (*Riv. Soc. Ent. Ital.*, 47 (1915), No. 1-4, pp. 79-275, figs. 92).—A synopsis of the Italian species.

Further investigations on the economic importance of the Gramang ant, P. VAN DER GOOT (*Meded. Proefstat. Midden-Java*, No. 22 (1916), pp. 129, pls. 6; *abs. in Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 7, pp. 273-276).—A report of further studies of *Plagiolepis longipes* in Java (*E. S. R.*, 35, p. 467), and particularly of control measures. An account of the green scale (*Coccus viridis*) and its natural enemies is appended (pp. 68-91).

The silverfish or "slicker," an injurious household insect, E. A. BARTON (*U. S. Dept. Agr., Farmers' Bul.* 902 (1917), pp. 4, figs. 2).—This supercilious *Blattella germanica* was previously noted (*E. S. R.*, 33, p. 459).

Notes on mites attacking orchard and field crops in Utah. R. W. DOANE (*Science, n. ser.*, 46 (1917), No. 1182, p. 192).—During the summers of 1915 and 1916 the author found certain mites to be particularly abundant and destructive to grains in Utah. Of these the red spider mite (*Tetranychus bimaculatus*) was the most important. Of the field crops corn suffered the most and many wheat fields sustained considerable losses as a result of its attack. During 1916 it was also injurious to fruit trees, bush fruits, truck crops, and sugar beets as well as ornamental plants. Earlier in the season wheat plants were attacked by the clover mite and *Tetranobia longipes*, both of which were also destructively abundant on barley, oats, and many wild grasses.

Studies on North American Polystomidae, Aspidogastridae, and Paramphistomidae. H. W. STUNKARD (*Ill. Biol. Monographs*, 3 (1917), No. 3, pp. 114, pls. 11).—This paper contains the results of a study of the structure and classification of North American representatives of trematodes of the families Polystomidae, Aspidogastridae, and Paramphistomidae. Seven species are described as new. A bibliography of 109 titles is included.

FOODS—HUMAN NUTRITION.

The American papaw and its food value. C. F. LANGWORTHY and A. D. HOLMES (*Jour. Home Econ.*, 9 (1917), No. 11, pp. 505-511).—Data are summarized regarding the papaw, a native wild fruit with pronounced flavor, which has always been gathered and eaten in regions where it grows, but which, owing perhaps to difficulties in shipping, has been marketed only in a limited way. Although cases of illness have been attributed to eating the papaw, there seems to be no definite evidence to indicate that it is other than wholesome.

Tables are included reporting the weight of fruit, seeds, skin, and pulp of 10 specimens, the pulp averaging 74.8 per cent. The edible portion as analyzed contained 76.6 per cent water, 5.2 per cent protein, 0.9 per cent of fat, 16.8 per cent carbohydrates, and 0.5 per cent ash. The carbohydrates contained 16 per cent sucrose and 35 per cent reducing sugar. The fuel value was 435 calories per pound.

Although very generally eaten out of hand or as a table or dessert fruit, some attempts have been made to use the papaw in cookery. The tests made in connection with the study reported have led to the conclusion that the flavor of the fruit is not improved by the action of heat in cooking, but rather the reverse. Good results, however, were obtained when fresh papaw pulp was used in making a frozen cream.

Home preparation of breakfast foods and flour from whole grain. G. A. OLSON (*Washington Sta. Bul.* 112 (1917), pp. 15, figs. 8).—Directions are given for the preparation of various wheat and corn products as well as combinations with flax seed and legumes.

Vinegar investigation.—A study of the changes that cider undergoes during fermentation and prolonged storage and its subsequent conversion into vinegar in rotating generators, B. G. HARTMAN and L. M. TOLMAN (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 8, pp. 759-762).—Analyses show that during fermentation a large part of the malic acid of the apple juice is changed to lactic acid, which is the chief fixed acid of vinegar. The remaining malic acid is almost entirely oxidized during acetification. Acetates are present in the vinegar and there are indications of minute amounts of formic acid. Potassium carbonate makes up 75 per cent of the ash.

Food value of the fresh and pickled herring. T. H. MILROY (*Roy. Soc. [London], Food (War) Com.*, 1917, Aug. 9, pp. 4+5).—This comprises analyses and

methods of packing. A brief report on smoked herrings, by T. W. Fulton, is included.

The Bureau of Markets in its relation to the conservation of foods, C. J. BRAND (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 66-69).—This includes a statement of the food situation here and abroad, and an account of the food surveys now being made by the Bureau of Markets. Two inventories are being made, one preliminary and the other more comprehensive. The work will cover the stocks on hand on farms; in wholesale, jobbing, storing, manufacturing, retail, and other commercial establishments; and consumers' stocks, consumption records, and a dietary study. In the dietary survey the Office of Home Economics of the States Relation Service is cooperating.

Rules and regulations of the Secretary of Agriculture under the food products inspection law of August 10, 1917 (*U. S. Dept. Agr., Office Sec. Circ.* 22 (1917), pp. 8).—The text of these rules and regulations is given.

Experiments in teaching food values (*Univ. Ill. Bul.*, 14 (1917), No. 49, pp. 22).—The bulletin includes menus for different seasons of the year, a study of the dietary habits of cafeteria patrons, meals for nine days and their costs in 1917, and a lesson in buying food.

Human food, considered in its relation to quantity and cost, A. MCGILL (*Lab. Inland Rev. Dept. Canada Bul.* 377 (1917), pp. 16).—The terms calories, protein, fat, and carbohydrates are explained and the food requirements of various individuals discussed. Tables are included showing the quantity of protein, fat, and carbohydrates in a pound of the most common foods and their cost per pound in Ottawa in June, 1917. Directions are also given on how to calculate dietaries.

Fats and oils in cooking.—Cooking temperatures, ANNA W. WILLIAMS and CORA E. GRAY (*Univ. Ill. Bul.*, 14 (1917), No. 47, pp. 19).—A popular treatise on the properties of fat, the value of fat as food, and the uses of different kinds in cooking.

On the presence of albumoses in the tissues and in the blood, with special reference to their occurrence in the gastro-intestinal mucosa, J. J. ABEL, M. C. PINCOFFS, and C. A. ROULLIER (*Amer. Jour. Physiol.*, 44 (1917), No. 3, pp. 329-343).—The authors report that albumoses can be isolated in varying amounts from the tissues of the body, including the cellular elements of the blood. No proteoses were separated from the plasma of the blood. Chemical procedures for the preparation of the albumoses from the gastric or intestinal mucosa, which is entirely devoid of pharmacological activity, are given. The gastro-intestinal mucosa contained from three to five times as much albumoses during the digestion of meat as after the deprivation of all food (except water) for four days.

The authors conclude that proteoses, as well as amino acids, are absorbed by the surfaces of the digestive apparatus. They were not able to trace the passage of proteoses from the mucosa to various organs via the blood current.

A bibliography is appended.

The production in dogs of a pathological condition which closely resembles human pellagra, R. H. CHITTENDEN and F. P. UNDERHILL (*Amer. Jour. Physiol.* 44 (1917), No. 1, pp. 15-66).—Dogs fed on boiled peas, cracker meal, and cottonseed oil rapidly developed symptoms of abnormal nutrition. The failure to thrive upon the dietary was not due to the low nitrogen intake, per se, since a higher level of intake did not prevent the onset of pathological changes though it delayed their appearance. The abnormalities were almost entirely confined to the alimentary canal and could be made to disappear by the addition of meat to the dietary, but if the meat content was reduced to an undefined limit the characteristic symptoms appeared and death eventually followed.

There was excellent utilization of the food. In the essential features the pathological manifestations closely resembled those observed in human pellagra. The authors conclude that it seems tenable that the abnormal state may be referred to a deficiency of some essential dietary constituent, presumably belonging to a group of hitherto unrecognized but essential components of an adequate diet.

ANIMAL PRODUCTION.

A manual of Mendelism, J. WILSON (London: A. & C. Black, Ltd., 1916, pp. [5] + 152, figs. 8).—A description of Mendel's law and deductions drawn therefrom. Various experiments in both plant and animal breeding are cited and discussed in their relation to Mendel's law. Practical suggestions are made to scientific breeders that should prove of value in their work.

Some applications of mathematics to breeding problems, R. B. ROBBINS (*Genetics*, 2 (1917), No. 5, pp. 489-504).—In this paper, which deals only with a single pair of typical Mendelian factors, the author (1) gives some examples to show the use of the methods of mathematical induction and repetition in the suggestion and establishment of formulas, (2) expresses the n th term of one of Jennings's series (*E. S. R.*, 34, p. 764) as a function of n , and (3) proposes a solution of the problem of inbreeding by brother and sister mating.

Dominance of linked factors as a means of accounting for heterosis, D. F. JONES (*Genetics*, 2 (1917), No. 5, pp. 466-479, fig. 1).—In this discussion of heterosis the author states that, on account of linked factors, the complete dominant or complete recessive can never or rarely be obtained.

"From the fact that partial dominance of qualitative characters is a universal phenomenon and that abnormalities are nearly always recessive to the normal conditions, it is possible to account for the increased growth in F_1 because the greatest number of different factors are combined at that time. It is not necessary to assume perfect dominance. It is only necessary to accept the conclusion that many factors in the $1n$ condition have more than one-half the effect that they have in the $2n$ condition. This view of dominance of linked factors as a means of accounting for heterosis makes it easier to understand (1) why heterozygosis should have a stimulating rather than a depressing or neutral effect, and (2) why the effects of heterozygosis should operate throughout the lifetime of the individual, even through many generations of asexual propagation."

The study of certain dietary conditions bearing on the problem of growth in rats, C. FUNK (*Jour. Biol. Chem.*, 27 (1916), No. 1, pp. 1-14, figs. 4).—The results reported note the influence of several specific substances which not only might add to the nutrition but also correct deficiencies in diet. The observations were made during a period of nearly two years' work with several hundred rats.

Dry or germinated oats, with sodium bicarbonate or alone, proved an unsuccessful diet for young rats. The quantity of vitamins necessary in their diet is not small. One per cent of yeast added to the ration is not enough; 3 per cent at least is necessary. While yeast can be regarded as a complete food in itself, replacing the total casein nitrogen by yeast nitrogen was not so satisfactory as using yeast in smaller amounts for its vitamin content rather than for its nutritive value. The substitution of orange juice for yeast gave no results. The growth was less when milk was used instead of yeast. The use of Lloyd's reagent did not give complete precipitation of the growth-promoting substances, while the yeast lost some of its properties as a stimulant to growth.

The Scandinavian methods of valuing and using feeding stuffs, J. WILSON (*Dept. Agr. and Tech. Instr. Ireland Jour.*, 17 (1917), No. 2, pp. 203-217).—The

methods discussed involve a return to those of the earliest German investigators, where one feed is fed against another in a standard ration. The results are expressed comparatively with one food used as a basis, as barley. The tables of comparative values are estimated for different classes of animals.

In the actual practice of feeding, further economies are found in basing the ration upon the gains sought, the work to be done, and the milk yield. In the last case, for example, the ration is based upon the weight of the cow, and the daily yield of milk.

Feeding stuffs, F. J. LLOYD (*Jour. Brit. Dairy Farmers' Assoc.*, 31 (1917), pp. 119-129).—A paper presented by the chemist of the association containing a résumé of the value of feeding stuffs and directions for purchasing them to the best advantage for individual needs.

The composition of some South Indian foodstuffs and fodders, W. H. HARRISON (*Madras Agr. Dept. Yearbook*, 1917, pp. 62-72).—A long list of fodders analyzed is given. Among those mentioned are *Eleusine coracana*, *Pennisetum typhoides*, *Cicer arietinum*, *Phaseolus mungo radiatus*, *P. aconitifolius*, *Cajanus indicus*, *Dolichos biflorus*, *D. lablab*, *Sesamum indicum*, Guinea grass, spineless cactus, and Tef grass hay.

The feeding value of the hay of seed vetch and cleaned vetch, J. GAÛH and I. D. GÖRTZ (*Kisérlet. Közlem.*, 19 (1916), No. 2, pp. 387-390).—In a trial with two sheep, it was found that with a water content at 12 per cent the seed vetch hay contained 8.1 per cent digestible protein and 36.8 per cent nitrogen-free extract; the cleaned vetch hay, 101.1 protein and 37.8 nitrogen-free extract.

Observations on silage, A. W. OLDESHAW (*Jour. Bd. Agr. [London]*, 22 (1917), No. 11, pp. 1063-1072, pl. 1).—A discussion of methods of ensiling practiced in East Anglia, with a description of the more modern types of silos that should be used.

The leaves and crowns of sugar beets as feed, L. MALPEAUX (*Vie Agr. et Rurale*, 6 (1916), No. 48, pp. 386-390).—A compilation and discussion of results of feeding beet tops fresh, dried, and ensiled.

Sugar beet leaves as cattle feed, E. SAILLARD (*Vie Agr. et Rurale*, 7 (1917), No. 38, pp. 207, 208, fig. 1).—A description of the practice of ensiling sugar beet residues in France, together with analyses of ensiled pulp and leaves.

Commercial feeding stuffs, A. J. PATTEN, E. F. BERGER, E. A. DE WINDT, and A. E. SMOLL (*Michigan Sta. Bul.* 279 (1917), pp. 3-66, figs. 8).—This contains the text of the new feeding stuffs law becoming operative April 1, 1918, and analyses of various brands of commercial feeding stuffs, including cottonseed meal and feed, linseed meal, distillers' dried grains, brewers' dried grains, corn gluten feeds, hominy feeds, corn meal, tankage, granulated bone, meat scrap, alfalfa meal, wheat bran and middlings, pea bran, barley bran, and proprietary feeds.

A smaller number of samples were analyzed this year than last, due probably to the scarcity of feeding stuffs on the market. Of the 837 samples analyzed 16.2 per cent were below guaranty in protein or fat, this number of deficiencies being 4 per cent below that found last year, while 15.4 per cent had an excess of crude fiber over the guaranty. A large amount of weed seed was found in scratch feeds for poultry, some of which were very objectionable. One sample containing seeds of night-shade was fed to hens, all of which were affected, two dying.

Attention is called to the use in feeding stuffs of by-products from palm oil manufacture, copra oil meal, and cacao shells.

Analysis of feeding stuffs, B. E. CURRY and T. O. SMITH (*New Hampshire Sta. Bul.* 184 (1917), pp. 16).—During the year 302 samples of feeds were col-

ated and analyzed. The percentage of ash and moisture was determined and carbohydrates estimated by difference.

The feeds examined included wheat middlings, bran, low-grade flour, cottonseed meal, hominy feed, molasses feeds, miscellaneous compounded feeds, alfalfa and clover meals, dried beet pulp, brewers' and distillers' grains, gluten feeds, linseed meal, meat and bone feeds, oat feeds, and provenders.

Feeding stuffs report, 1915, J. W. KELLOGG (*Penn. Dept. Agr. Bul. 280* [1916], pp. 271).—The usual chemical and microscopical examination of samples selected under the act regulating the sale of concentrated commercial feeding stuffs is reported. The analyses include cottonseed meal, linseed meal, coconut meal, corn oil meal, ivory nut meal, distillers' dried grains (from corn and rye), yeast dried grains, brewers' dried grains, malt sprouts, corn gluten meal, corn gluten meal, hominy feed, corn bran, corn feed meal, low-grade flour, wheat middlings, wheat bran, rye middlings, oat feed, oat hulls, buckwheat middlings, buckwheat feed, alfalfa meal, dried beet pulp, various mixed and proprietary feeds, animal by-products, and condimental stock and poultry feeds.

Commercial feeding stuffs, 1916-17, [and] Texas feed law, B. YOUNGBLOOD (*Texas Sta. Bul. 216* [1917], pp. 5-385).—This contains the text of the law regulating the sale of feeding stuffs in Texas and an explanation and discussion of its requirements, together with a list of manufacturers and tables of analyses of feeding stuffs examined, including alfalfa meal, blood meal, corn chop, corn gluten feed, ground corn cob, corn bran, cottonseed cake, cottonseed meal, cottonseed feed, cold-pressed cotton seed, dried beet pulp, dried brewers' grains, ear corn chop, feterita chop, hominy meal, Kafir corn chop, linseed meal, oat meal, milo maize chop, ground oats, ground oat hulls, peanut meal, peanut cake, whole pressed peanuts, ground peanut hay, ground bone, rice bran, rice polish, ground rice hulls, tankage, wheat bran, wheat shorts, and various mixed and proprietary feeds.

[Animal husbandry work], C. N. ABBETT (*Montana Sta. Rpt. 1916*, pp. 170-172).—The animal husbandry department has, owing to economic conditions, given special attention to the utilization of cheap feeds.

Thirty head of high-grade beef cattle were divided into two lots, one wintered on straw alone and the other on straw with the addition of 8.8 lbs. of hay per head daily. The results showed that when cattle start in in good condition in late fall they can be wintered on straw. In this experiment the cattle receiving hay as part ration were in better condition than those receiving straw alone.

In a trial with fattening two lots of yearling cattle the results were not conclusive, but indicate that it is more profitable to feed less grain and more hay than is the practice in many sections. Feeding Giant Russian sunflowers to dairy cattle for a short period (nine days) indicated that this crop, which gave a yield of 22 tons per acre without irrigation, was equal pound for pound to corn and clover.

In growing and fattening pigs the results indicated that a light grain ration fed to pigs on forage is a profitable practice. As supplements to barley and wheat, animal products, skim milk and tankage, gave better results than peas and alfalfa, while the peas were slightly more efficient than the alfalfa.

Report of the animal husbandman, C. A. WILLSON (*Tennessee Sta. Rpt. 213*, pp. 153-155).—During the year the station had 48 experimental groups of cattle and hogs, among them 328 steers. The rations tested have been mainly cottonseed products and silage. As in previous reports medium rations of cottonseed meal have given more economical returns than large rations. Silage was more efficient than cottonseed hulls.

An experiment was carried out with 15 pigs in lots of 3 each, testing the effect of iron salts when fed with cottonseed meal as suggested by the North Carolina Station. In lot 1, fed on corn meal and cottonseed meal (4:1), the pigs made practically no gains. In lot 4, fed on corn meal and cottonseed meal (2:1), two of the pigs died and the other, like the animals in lot 1, became very much emaciated. The pigs in lot 2, fed on corn meal and cottonseed meal (4:1) and 1 lb. of iron sulphate for every 50 lbs. of cottonseed meal, lot 3 with the same except that 1 lb. of iron chlorid was given instead of iron sulphate and lot 5 on corn meal and cottonseed meal (2:1) and 1 lb. iron chlorid made good gains and were not detrimentally affected by the ration.

Feeding experiments with cattle, sheep, and pigs (*County Northumb. Ex. Com. Bul. 23 (1916), pp. 3-26*).—Several experiments of special value to the locality in which they were carried out are reported.

In an experiment comparing the value of bran and dried brewers' grains, 24 cattle 18 months old were fed for 16 weeks in four lots. Lots 1 and 2 consisted of bullocks, while lots 3 and 4 consisted of heifers. Standard rations containing soy cake and Bombay cotton cake were fed lots 1 and 3, while a ration of bran and sufficient soy cake to bring the digestible constituents up to the standard was fed lot 2, and a ration of dried brewers' grains and soy cake was fed lot 4. The bullocks receiving the cake ration made an average gain per head of 15½ lbs. per week, while those receiving bran made an average gain of 16½ lbs. per week. As bran was a higher priced feed, the cost of the gains with bran was higher than with soy cake. The heifers receiving the cake ration made an average gain of 11½ lbs. per week, while those receiving dried brewers' grains made an average gain of 12 lbs. per week. The economic results, however, were favorable to the cake ration.

A similar experiment was carried out with sheep in 3 lots of 16 each. Lot 1 receiving cake alone, gained an average of 1.93 lbs. per head weekly; lot 2 receiving bran, gained 1.95 lbs.; and lot 3, receiving dried brewers' grains, 1.98 lbs.

The above experiments showed little difference in the feeding values of the same amounts digestible constituents in the different feeds used.

In an experiment to determine the feeding value of swedes and yellow turnips, 24 calves were divided into 3 lots, lot 1 consisting of 12 calves and lots 2 and 3 of 6 each. Lot 1 received no roots, but was given enough hay and concentrates to supply the same amount of nutrients as was received by lot 2 with swedes in the ration, and lot 3 with yellow turnips. The calves fed on hay and concentrates gained an average of 6.7 lbs. each per week, those on swedes 6.7 lbs., and those on yellow turnips 6.5 lbs. It appears that swedes and yellow turnips are of substantially equal value for the same amounts of dry matter.

"It has now been demonstrated for four winters in succession that young cattle from six to twelve months old can be wintered with excellent results on pasture, if they have access to a shelter shed and receive suitable additional food to the pasture. At the end of the winter those wintered outside have better coats of hair and will command higher prices as grazing cattle. They also possess the great advantage of practical freedom from tuberculosis."

In a trial of feeding cattle with and without salt it was found that there was practically no difference in the effects. The same result was noted with sheep. It is the usual practice in the locality, which is six miles from the seacoast, not to use salt in fattening cattle or sheep, either indoors or on pasture.

Experiments were made to determine whether it was possible to feed pigs profitably on meals alone. Maize and gram, an Indian pea, were the meals

tested. The gains were satisfactory, although the amounts of meals fed were smaller than the usual practice in the locality. A larger proportion of the grain was needed in the earlier periods of feeding.

Emergency cow feeds. H. K. GAYLE (*Mississippi Sta. Bul. 181 (1917), pp. 6.*)—Experiments in utilizing various waste forages for wintering cattle are reported. The forages were fed to breeding beef cows, divided into six lots of four cows each, with 1 lb. of cottonseed meal additional per head per day. The feeding lasted 28 days.

Pasture grass hay made up of native grasses, mostly overripe, was fed at a cost of \$2.60 per ton. The cows consumed, besides the cottonseed meal, an average of 23.53 lbs. of the hay per head daily and gained 17.65 lbs. each in weight during the feeding period. The cost of the ration was 5.7 cts. daily. On a ration including oat straw, valued at \$5 per ton, the cows gained an average of 52.1 lbs. each for the period. They consumed 24.8 lbs of straw daily and the entire ration cost 8.2 cts. daily. On forage cut from the corn fields, made up of cornstalks, grasses, and weeds put in the stack at a cost of \$1.32 per ton, the animals used an average of 38.06 lbs. daily at a ration cost of 4.5 cts. daily. They lost 32 lbs. each during the period.

Cotton stalks from a field practically destroyed by the boll weevil were cut before the leaves had fallen and stacked at a cost of \$2.30 per ton. The animals cleaned up an average of 27.48 lbs. per day and lost during the period 10.75 lbs. each. The cost of the ration was 5.2 cts. per day.

Silage was made from cotton heavy with leaf that was cut from a field severely damaged by boll weevil. It yielded at the rate of 4.5 tons of silage per acre and at an expense of \$2.70 per ton. The animals consumed a daily ration of 38.68 lbs. and gained 33.7 lbs. for the period. The cost of the ration was 3.9 cts. daily.

Another field of cotton ruined by the boll weevil was cut and put in the silo in alternate loads with sorghum. The mixture was by weight $\frac{1}{2}$ cotton and $\frac{1}{2}$ sorghum, and was worth \$2.90 per ton. The animals consumed an average of 40.9 lbs. of the silage per head daily and gained 13 lbs. each for the period, at a ration cost of 9.2 cts. daily.

A statistical study of body weights, gains, and measurements of steers during the fattening period, B. O. SEVERSON and P. GERLAUGH (*U. S. Dept. Agr. Jour. Agr. Research, 11 (1917), No. 8, pp. 383-394, pls. 2.*)—It is the purpose of this paper to establish some relation between body measurements of beef cattle and the gains in weight during fattening which might possibly prove a more scientific method of judging cattle than certain formula and rules now followed. The animals under observation were those fed in various experiments during three winters at the Pennsylvania Experiment Station.

As the process of fattening is the deposition of fat and muscular growth, the regions of the body most heavily covered naturally show the greatest development; also, the most valuable parts of the animal from a beef standpoint are most affected in the fattening process.

The usual measure of gain in steers is the increase in live weight. From the correlation of 338 steers fed at the Pennsylvania Station there was no relation in the daily gain which might be expected in weights of animals of close relation as to age and condition.

From the trials made it appears that the circumference of chest and rear flank, the width of hip joints, and the distance from hip to buttock indicate the closest relationship between measurements and gains in weight. The circumference of chest and rear flank are of more importance in indicating gains than feeding capacity as indicated by the circumference of the paunch.

Wool growing in Australia, R. W. HARKOWELL (*Nat. Wool Grower*, 7 (1917), No. 10, pp. 11-13).—Sales to the British Government were made the last season of 323,748,376 lbs. greasy wool and 34,310,645 lbs. scoured wool. The average price of greasy wool was 29.5 cts. per pound, or on a clean cost basis of 31 cts. The most serious drawback to sheep raising during the year was the blow fly, causing losses estimated at £378,000. To avoid losses from drought, larger storage of hay, fodder, and silage is being practiced.

The economical feeding of pigs, G. TURNBULL (*Jour. Brit. Dairy Farmers Assoc.*, 31 (1917), pp. 130-136).—A résumé of results from various experiments.

War rations for hogs (*Wallaces' Farmer*, 42 (1917), No. 42, pp. 1415, 1420, figs. 2).—At a farmers' meeting held at Ames, Iowa, the results of various experiments with new and by-product feeds were announced. The various feeds were fed to over 100 hogs. Among the unusual feeds were corn oil cake meal and garbage.

When three self-feeders were used, the first containing shelled corn, the second meat meal or tankage, and the third corn oil cake, the average daily gains on timothy pasture were 1.38 lbs. per head, as compared with 1.11 lbs. on a typical shelled corn, meat meal, or tankage ration, self-fed. With garbage before them at all times, the hogs gained about 1 lb. a day. With hogs at \$15, the daily value of the garbage from 100 persons is estimated at about 86 cts.

Pushing pigs on alfalfa pasture, J. M. EVVARD and R. DUNN (*Ill. Agr.*, 21 (1917), No. 7, pp. 474, 475, 507).—To test the value of alfalfa pasture for pigs, six lots about 2½ months old and weighing approximately 55 lbs. each were fed until they averaged 225 lbs. The first five lots were pastured on alfalfa and were fed in addition as follows: Lot 1, one-half ration of shelled corn and meat meal tankage twice daily; lot 2, three-quarter ration of shelled corn and meat meal tankage twice daily; lot 3, shelled corn to the limit of appetite and meat meal tankage twice daily; lot 4, same as lot 3 but fed three times daily; and lot 5, shelled corn self-fed and meat meal tankage self-fed. Lot 6 was kept in a dry lot and given shelled corn self-fed.

The best returns were produced by lot 5, which made faster gains on the smallest amount of both corn and tankage, requiring 3.74 lbs. of concentrated feed per pound of gain. Lot 4 came next, with a requirement of 3.89 lbs. feed per pound of gain, followed by lots 2 and 3.

The value of the alfalfa pasture in comparison with that of the concentrated feed saved was \$30 per acre, and with one crop of hay cut the same season, the total value was \$42 for the year.

The value of potatoes in swine feeding, F. G. ASHBROOK (*Proc. Potato Assoc. Amer.*, 3 (1916), pp. 79-83).—A general discussion of the subject, with data from various experiments.

Studies on the physiology of reproduction in the domestic fowl.—XVII. The influence of age upon reproductive ability, with a description of a new reproductive index, R. PEARL (*Genetics*, 2 (1917), No. 5, pp. 417-432, figs. 3).—Statistical evidence accumulated in nine years' work at the Maine Experiment Station regarding the influence of age upon reproductive capacity in Barred Plymouth Rock fowls is presented. As a result of this study, which involved 1,114 matings, an index is proposed for the measurement of the net reproductive ability of matings of the fowl. This index expresses the actual number of chicks produced by the mating and capable of living three weeks after hatching as a percentage of the maximum total number of chicks which it would be physiologically possible for the mating to produce during the time which it endures, or one living chick three weeks of age per hen for each day during which the mating existed.

For the strain of Barred Rocks used, and under the conditions of environment and management which obtained during the experiments, the reproductive index has a mean value of about 12 per cent. Net fertility, as measured by the reproductive index, is a rather highly variable character, agreeing in this respect with other purely physiological characters. Reproductive ability, as measured by the index, diminishes with advancing age of the birds mated, having its maximum when each of the birds mated is from 10 to 14 months of age. The decline in reproductive ability with advancing age is at a more rapid rate in the case of the males than in the case of the females. The results above stated are to be understood as being limited, for the present, to the breed, strain, and circumstances which furnished the data. How wide their generality may be is a matter yet to be investigated."

Standard varieties of chickens.—II, The Mediterranean and Continental classes, R. R. SLOCUM (*U. S. Dept. Agr., Farmers' Bul. 898 (1917), pp. 25, figs. 22*).—This continues work previously noted (*E. S. R., 37, p. 368*).

In addition to notes on the importance of egg production in the United States and the characteristics of the egg breeds, a general statement is made of the appearance and characteristics of the different varieties of Leghorn, Minorca, Spanish, Blue Andalusian, and Ancona breeds of the Mediterranean class and the Campine breed of the Continental class of fowls. Suggestions for breeding Brown Leghorns for exhibition purposes and notes on the inheritance of color in the Andalusian fowl are given.

(Poultry investigations), W. F. SCHOPPE (*Montana Sta. Rpt. 1916, pp. 179-181*).—Animal food (skim milk, green cut bone, commercial meat scrap, and fish scrap) showed a marked increase in egg production. For the entire year the best results were obtained with skim milk. During the winter months green cut bone proved greatly superior, but owing to its decomposing its general use is not recommended during warm weather.

In fattening poultry satisfactory gains in weight were made and improvement in quality. Ground barley fed in a mixture of other grains made a desirable feed for poultry. Gains of 15 to 30 per cent were made with chickens fed in crates for 17 days. Buttermilk and skim milk were superior to water in mixing mash. Conditioning poultry before marketing will pay in increased weight, while the improvement in quality should bring an extra price.

Owing to the cool nights prevailing in Montana it takes longer to mature chicks and they should be hatched early in the spring, March or April. Pullets should be well matured to start laying before cold weather sets in. From data collected on egg production it appears that a hen makes her best yields during the first laying year. However, with 24 Leghorn hens at the station more eggs were produced during the second and third years, and nearly as many during the fourth, as in the first year.

The present cost of egg production, H. R. LEWIS (*New Jersey Sta. Hints to Poultrymen, 6 (1917), No. 2, pp. 5*).—Data are reported showing that for ten months from November, 1915, to August, 1916, the average price of brown eggs at the New York wholesale market was 31 cts. per dozen, while for the same period in 1916-17 it was 41.69 cts. The average price of white eggs during the same period increased from 34 cts. to 44.81 cts. In the same time dry mash increased 53.66 per cent and grain rations 74.6 per cent. It is shown in tables, however, that with the increased price of eggs and costs of feed the profits per hen were higher in 1916-17 than in 1915-16.

To further increase profits it is urged that the average egg production per hen be increased by selection and breeding.

Back-yard poultry keeping, R. R. SLOCUM (U. S. Dept. Agr., *Farmers' Bul.* 889 (1917), pp. 22, figs. 13).—Attention is called to the value of a small flock of hens kept in the back yard as a means of reducing the cost of living of the family and enhancing the aggregate of food produced. Egg production rather than breeding poultry and the utilization of waste foods from the household are the main points brought out. The following suggestions are given: The size of the flock should be at least ten well-matured pullets rather than hens; scraps from the table and some green feed grown in the yard should make up most of the feed; no male should be kept as egg production throughout the season should be sought; and in the fall when the hens stop laying and begin to molt they should be killed for the table. Other useful suggestions as to housing and management are incorporated.

DAIRY FARMING—DAIRYING.

The rôle of water in a dairy cow's ration, C. LARSEN, E. H. HUNGERFORD, and D. E. BAILEY (South Dakota Sta. Bul. 175 (1917), pp. 649-692).—This investigation was conducted for the purpose of ascertaining the effects of watering the cow at different intervals and in varying amounts upon the amount of food consumed, digestibility of nutrients, amount and composition of feces and urine, amount and composition of milk, composition and quality of milk fat, body temperature, and physical condition of the cows. The bulletin also furnishes some data on the mineral metabolism of the cow.

Four cows were used during the first part of the experiment, January 2 to September 20, 1914, and three different cows during the second part, November 16, 1915, to January 26, 1916. There were three experimental periods of 30 days each, preceded in each case by a preliminary period of 30 days. During the first two preliminary periods the cows were watered every 8 hours, and during the third preliminary period they were watered every 12 hours. During the first experimental period the cows were watered once in 24 hours. During the second experimental period one cow was watered once in 12 hours and the other three cows once in 60 hours. In the third experimental period one cow was given a full allowance of water once in 24 hours and the other two cows one-half an allowance once in 24 hours. The rations consisted of 8 lbs. of a grain mixture of oats, bran, and linseed meal (3:3:1), 25 lbs. of corn silage, 1 oz. of salt, and all the hay they would eat. The amount of feed and water consumed, milk produced, and urine and feces voided was recorded, and samples of each were analyzed at stated intervals. The changes in milk fat constants during the experimental periods were also determined.

During the first 60-day period the four cows together consumed daily about 7 lbs. of hay less, 2 lbs. of silage less, and 9 lbs. of water less when they were watered but once each day than when they were watered once each 8 hours. There was also a slight decrease in milk, amounting to nearly 2 lbs. per day. The cows lost an average of 11 lbs. each during the first experimental period, while during the preliminary period they gained 18 lbs. each. When the cows received water once in 60 hours they lost 17 lbs. in weight in 30 days. When they received only one-half the normal amount of water every 24 hours they lost an average of 95 lbs. each in 30 days. In the periods when the cows received a full quota of water at long intervals there was not a very decided decrease in milk production. When they received only one-half the normal amount of water every 24 hours the milk flow decreased from an average of 18.26 to 14.06 lbs. daily. There was also a noticeable decrease in the amount of hay consumed.

The coefficient of digestibility was found to increase in each of the experiments where the interval between watering was lengthened, and also in the period where the cows received only one-half their normal water requirement. This increase was most noticeable for crude fiber, the digestibility of which was apparently increased from 55.7 to 71 per cent when water was withheld for 60 hours. The amount of crude fiber digested was also greater during the experimental periods than during the preliminary periods. The increase in digestibility of nitrogen-free extract and protein due to withholding water was not regular or marked.

The frequency of watering did not appear to have any appreciable effect on the composition of the feces, except that watering less frequently slightly reduced the crude fiber. When the cows received only one-half their normal water requirement there was an increase in the percentage of protein and nitrogen-free extract and also in crude fiber of the feces. The amount of feces voided bore a close relation to the amount of feed eaten. From this work it appears that the amount of dry rough feed consumed by the cow is closely related to the amount of water drunk.

No variation in the composition of the milk or milk fat was found that could be ascribed to lack of water. Analyses were made of the ash of the milk in the last two experiments. The results were normal.

When the cows were watered not less than once in 24 hours the body temperature was lowered only a fraction of a degree Fahrenheit, and this change in temperature occurred within 15 minutes after drinking the water. When the cows were watered once in 60 hours the body temperature was reduced 2° within 1.5 hours after watering. When the cows received only one-half the normal amount of water once in 24 hours the average body temperature was about 1° higher than when they received the full amount of water.

In order to ascertain more definitely the effect of a high body temperature of healthy cows on the percentage of fat in milk secreted, a series of experiments was conducted. Four grade cows were placed in a room, the temperature of which was made to vary from 51 to 104°. In each trial the cows were given water tempered to the same degree of heat as that of the room. When it was desired to increase the body temperature the cows were also blanketed. At a room temperature of 69° and body temperature of 101.2°, the average percentage of fat was 4.4. When the average room temperature was 104° and the body temperature 104.8° the average percentage of fat was 5.04. The amount of fat, however, was not increased in the same ratio.

The abnormal physical characteristics due to lack of water were nervousness, gaunt appearance, and high body temperature. A larger amount of energy was required per 1,000 lbs. live weight to accomplish the body functions when the water was given once in 60 hours and when only one-half amount of water was supplied the cows.

The chief uses of water by the dairy cow are summarized. Tabulated data obtained in these experiments indicate that 12 per cent of the water drunk in winter and 27 per cent in summer is eliminated through the skin, about 56 per cent of the water is eliminated in the feces and 13 per cent in the urine, and about 15 per cent of the water ingested is used for milk production. One of the cows, a heavy milker, used about 24 per cent of the water for milk production.

Tabulated data are appended, showing the average daily rations and water consumed and the food-nutrient balances for each cow in the experiment.

Tests of three protein concentrates and two leguminous roughages in milk production, O. F. HUNZIKER and R. E. CALDWELL (*Indiana Sta. Bul. 203* (1917), pp. 3-20, figs. 8).—This experiment was conducted for the purpose of compar-

ing cottonseed meal, linseed meal, and gluten feed and alfalfa hay and soy-bean hay for milk production. Three lots of 5 cows each were fed for 180 days, the feeds being changed at the end of each 30-day period. During the test each lot received in addition to ground corn and corn silage (1) cottonseed meal and alfalfa hay, (2) cottonseed meal and soy-bean hay, (3) linseed meal and alfalfa hay, (4) linseed meal and soy-bean hay, (5) gluten feed and alfalfa hay, and (6) gluten feed and soy-bean hay. Analyses are given of the feeds used in the experiment.

The cows consumed approximately 1 lb. of grain and 1 lb. of hay per 100 lbs. of body weight. A larger amount of alfalfa hay was consumed than of soy-bean hay. The grain mixture was compounded according to a standard that would insure a uniform nutritive ratio for all the rations tested. The corn and cottonseed meal were mixed in the proportion of 16:1 when fed with alfalfa hay, and 10:1 when fed with soy-bean hay. Corn and linseed meal were mixed in the proportion of 14:1 when fed with alfalfa hay, and 7:1 when fed with soy-bean hay. When fed with alfalfa hay corn and gluten feed were mixed in the proportion of 8:1, and with soy-bean hay, 4:1. The daily dry matter consumption per cow varied from 20.82 to 22.9 lbs. and the protein consumption from 2.52 to 2.7 lbs. for all the rations. After the first 30-day period, during which the cows gained an average of slightly over 1 lb. each daily, they uniformly gained about $\frac{1}{2}$ lb. on soy-bean hay and lost about an equal amount on alfalfa hay. However, the nutritive ratios of the rations containing alfalfa hay averaged 1:7.81, and of those containing soy-bean hay, 1:8.92.

The cows averaged 19.64 lbs. of milk and 0.9 lb. of fat per day on the alfalfa hay rations, and 18.41 lbs. of milk and 0.86 lb. of fat on the soy-bean hay rations. The feed cost of producing 100 lbs. of milk averaged 99 cts. on the alfalfa hay rations, and \$1.07 on the soy-bean hay rations. There was only a very slight variation in the feed cost of milk due to the type of protein-carrying concentrates used. At \$15 per ton alfalfa hay returned 10 cts. more per dollar invested than soy-bean hay. The data brought out in the experiments are illustrated graphically.

Nutrients returned by dairy cows.—Stage of lactation and individuality affect cost of milk production, R. I. GRADY (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 11, pp. 365-369, fig. 1).—Data obtained from 36 herds consisting of 720 cows in various parts of the State indicate that, of the feed consumed by these cows from November to April, 7.71 per cent of the total digestible nutrients was suitable for human food.

During the first month of their lactation period 157 Jerseys returned as milk solids 22.2 per cent of the digestible nutrients consumed, and during the tenth month 7.3 per cent. Similarly, 131 Holsteins during the first month of their lactation period returned 19.2 per cent, and during the tenth month only 6.8 per cent of the digestible nutrients consumed. During the 10 months of the lactation period the Jerseys made an average return of 15.8 per cent, and the Holsteins 14.9 per cent.

The best Jerseys required 3.3 lbs. and the best Holsteins 3.9 lbs. of digestible nutrients for each pound of total solids produced. The poorest Jerseys required 9.4 lbs. and the poorest Holsteins 11.8 lbs. of digestible nutrients for each pound of solids produced.

Breeds of dairy cattle, H. P. DAVIS (*U. S. Dept. Agr., Farmers' Bul.* 853 (1917), pp. 34, figs. 19).—This outlines the factors to be considered in the selection of a dairy breed, and discusses the origin and characteristics of the Ayrshire, Brown Swiss, Guernsey, Holstein-Friesian, and Jersey breeds. The official score card for cows adopted by each of the breed associations and the

production record of the 10 highest producers of milk and milk fat, the more prominent families, and the performance records of a number of leading bulls of each breed are also given. The average production for cows that have completed yearly records for advanced registry is shown in the following table:

Average production of cows completing yearly records for advanced registry.

Breed.	Number of cows.	Milk production.	Fat content.	Fat production.
		<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>
Ayrshire.....	2,598	9,555.00	3.950	377.51
Brown Swiss.....	199	10,868.70	3.995	433.45
Guernsey.....	6,300	8,934.44	4.990	466.01
Holstein.....	3,220	14,622.70	3.424	500.70
Jersey.....	5,244	7,792.00	5.350	417.00

[Milk preserved with formalin for calves], H. WELCH (*Montana Sta. Rpt.* 1916, p. 182).—Seven calves from one to two weeks old were fed skim milk to which enough formalin had been added to keep it sweet for four to six days at temperatures averaging 80° F. As a check, seven calves were fed on untreated skim milk. During the six weeks of the test the two lots gained equally in weight, and the calves on formalin-preserved milk were in every way as thrifty and healthy as the other lot.

The milking machine as a factor in the production of sanitary milk, G. L. A. RUEHLE, R. S. BREED, and G. A. SMITH (*Amer. Jour. Pub. Health*, 7 (1917), No. 10, pp. 840-846).—Results of bacteriological analyses seem to show that the machines on the market can be successfully used to produce more sanitary milk than that obtained by hand milking.

Relationship of milk supplies to typhoid fever, W. H. FROST (*Pub. Health Rpts.* [U. S.], 31 (1916), No. 48, pp. 3291-3302; *abs. in Abs. Bact.*, 1 (1917), No. 5, pp. 410, 411).—This paper calls attention to the deficiency of our knowledge of the relationship between milk supplies and the prevalence of typhoid fever. The author suggests that the influence of a milk supply in disseminating typhoid fever is determined by (1) the sources of infection to which the milk is exposed, (2) the opportunities afforded for infective material to be introduced into the milk from these sources or the precautions taken to safeguard against the introduction of infective material, and (3) circumstances affecting the potentiality of the milk supply in disseminating infection after infective material has once been introduced. Opportunities for estimating the influence of milk supplies upon typhoid prevalence are pointed out.

Some observations on the bacterial examination of milk, F. H. SLACK (*Amer. Jour. Pub. Health*, 7 (1917), No. 8, pp. 690-697; *abs. in Abs. Bact.*, 1 (1917), No. 5, p. 411).—The author concludes that incubation of milk plates for 48 hours rather than 24 hours is advisable, since, on an average, the count is doubled or trebled. The use of meat extract media for milk counts should be abandoned, since it gives lower counts and the colonies are much smaller than with media made from fresh beef juice. A preliminary microscopic estimate of the number of bacteria in a milk sample by the smeared sediment method is advisable, (1) to rule out specimens of low bacterial content on which no further work need be done, and (2) to judge the proper dilution for specimens which must be plated.

A safe and sane milk supply, J. WEINZEL (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 10, pp. 127-130).—It is stated that pasteurized milk, when the process has been properly carried out, is safe so far as disease is concerned.

Certified milk is also satisfactory in this respect. A sane milk supply, however, must also be free from excessive dirt. To eliminate dirt the milk should be rated on the basis of laboratory tests, such as (1) total count, (2) *Bacillus coli* determination, (3) visible dirt test, and (4) *B. sporogenes* determination. It should be graded according to the laboratory tests into A, B, and C grades, and these stated upon the bottles and containers in which the milk is sold.

A sane milk supply must also be cheap enough to be within reach of the common people. For this purpose certified milk is a failure. If dairy demonstration supersedes dairy inspection and laboratory tests the score card in grading milk, and care is made superior to equipment in barns and machinery, then it is maintained that a clean milk may be had at a reasonable price as well.

Milk and its distribution in Philadelphia, T. B. HARRISON (*Philadelphia: Chamber Com., Ed. Committee, 1917, pp. 12, figs. 12*).—This number of the series of educational pamphlets issued by the Philadelphia Chamber of Commerce explains the methods of handling and safeguarding the milk supply of Philadelphia.

Dairying in Colorado, R. McCANN (*Denver, Colo.: Colo. Bd. Immigr. [1917], pp. 10, figs. 2*).—The development and future prospects of the dairy industry in Colorado are outlined.

VETERINARY MEDICINE.

Immune sera, C. F. BOLDUAN and J. KOOPMAN (*New York: John Wiley & Sons, Inc., 1917, 5. ed., rev., pp. VIII+206, figs. 9*).—This is the fifth edition of the work previously noted (*E. S. R.*, 26, p. 579). Neither the plan nor scope of the previous edition has been changed, but the entire material has been revised.

Dichloramin T and chlorinated eucalyptol 1.2, 2, R. B. KRAUSS and F. CREDE (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2720-2722).—The authors describe a method for the preparation of stable toluene-*p*-sulphon-dichloramid (dichloramin T), a method for the preparation of chlorinated eucalyptol (specific gravity 1.2), and other chlorination products of eucalyptol on a large scale.

Preparation of a preservative from cresol, MARY NEVIN and B. MANN (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 12, pp. 2752-2756).—Experimental data presented show that purified and redistilled cresol can be used as a preservative for biological products. The fraction boiling between 199 and 204° C. (specific gravity 1.03 at 25°) was best for this purpose. Its toxicity was found to be the same as phenol, slightly lower than that of "Tri-kresol," but having a germicidal coefficient of 2.55, which is higher than that of Tri-kresol.

It is indicated that investigations are being carried out to determine the practical value of preservatives in immune sera and purified antitoxin.

The toxin of *Bacillus welchii* (*Jour. Infect. Diseases*, 21 (1917), No. 6, pp. 580-599).—The two following papers are presented:

I. **Toxin production by various strains**, P. H. DeKruif, T. W. Adams, and P. M. Ireland.—The authors have studied the toxicogenic power of ten strains of *B. welchii*, and have found that all produce toxin in a greater or less degree. An antitoxin produced by the injection of toxin from a single strain neutralized all of the other toxins, a fact which indicates the common nature of the toxic products of the various strains. In studying various methods of toxin production, it was found that the usual layer of sterile paraffin oil was not necessary for securing growth or toxin production, and that methods of removing oxygen, such as exhaustion or absorption, were superfluous. Boiling the medium before use was found to be sufficient. A considerable concentration

of toxin was secured by the use of a veal broth medium instead of sterile rabbit muscle. Finely chopped veal was added to a 0.1 per cent glucose, +0.5 reaction, and autoclaved at 110° C. for 30 minutes. By the use of this medium the complication of technique was considerably reduced and a toxin concentration obtained as great as by any other procedure.

II. *The mechanism of infection with B. welchii*, P. H. DeKruif and J. L. Bellman.—The results of the study reported showed that "bacilli removed from broth cultures by centrifugation and subsequently washed with large volumes of 0.85 per cent NaCl are far less infectious than equal numbers of organisms not separated from the medium in which they have grown. The virulence of washed organisms is increased at least 10,000-fold by the simultaneous injection of nonlethal amounts of neutralized culture filtrate. This aggressive activity of the culture filtrate is destroyed by heating to 70° for 30 minutes, and by the addition of the specific Welch antitoxin."

From these results it is concluded that the aggrassin of the filtrate and the toxin are identical. "This conclusion is strengthened by the fact that sublethal amounts of toxin made by the muscle culture method show a similar aggressive effect, which is likewise neutralized by the addition of antitoxin. Nonspecific culture filtrates from cholera and proteus cultures do not increase the virulence of washed bacilli. The aggressive substance (toxin) seems to act by reason of its necrotic effect and not by a negative chemotactic influence on leucocytes."

The prophylactic and therapeutic properties of the antitoxin for *Bacillus welchii*, C. G. BULL (*Jour. Expt. Med.*, 26 (1917), No. 4, pp. 603-611).—"It has been possible to confer on guinea pigs a passive immunity of about two weeks' duration to *B. welchii* toxin through a protective administration of the antitoxin. Guinea pigs which had received a prophylactic dose of *B. welchii* antitoxin exhibited pronounced resistance to infection with the virulent bacilli for a period of 12 days. Established infections in guinea pigs with *B. welchii* have been arrested and controlled by treatment with the antitoxin."

Possibilities of the prevention of *B. welchii* infection in man through the prophylactic use of the antitoxin and the control of developed cases of the infection by therapeutic injections of the antitoxin are noted.

The colon-aerogenes group from silage, O. W. HUNTER (*Jour. Bact.*, 2 (1917), Vol. 6, pp. 635-639).—"A study of 95 coli-like cultures isolated from different kinds of silage (alfalfa, Kafir corn, and corn) and 15 from the growing fields (alfalfa and Kafir corn, made by the author at the Kansas Experiment Station, showed 48.18 per cent of the organisms to be *Bacillus lactis aerogenes*, 30.9 per cent *B. coli communior*, 10.9 per cent *B. coli communis*, and 10 per cent *B. lactis acidi*.

"Classified according to origin, as differentiated by methyl red, 79.08 per cent were nonfecal strains, while 20.9 per cent were of fecal origin. All the strains represented by the *B. coli communis* and *B. lactis acidi* groups were fecal types, while the organisms included in the groups represented by *B. coli communior* and *B. lactis aerogenes* were nonfecal strains. A correlation between the Voges-Proskauer reaction and the hydrogen-ion concentration was observed in all cultures. Litmus milk was coagulated by 90.9 per cent of all fecal strains, while 98.5 per cent of the nonfecal types exhibited only an acid reaction."

Properties of the serum of animals hyperimmunized against glanders and the choice of animals for the preparation of a serum rich in glanders antibodies, E. BERTETTI and G. FINZI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5. ser., 26 (1917), II, No. 5, pp. 131-135).—"From the work reported the authors conclude that it is possible to obtain from various animals (ox,

horse, mule, and ass) an antiserum which possesses strong precipitating powers for various glanders sera and filtrates of cultures of glanders bacilli, the precipitating substance being specific. The existence of a greater or less individual variation to glanders infection influences the production of antibodies in an inverse proportion. The production decreases progressively in the following order: Horse, mule, ass.

An animal should not be treated with the virus from the broth or agar culture, since the products appear to be neutralized in vivo by the antibodies. The soluble products from a suspension of *Bacillus mallei* should be used for the inoculation.

The precipitin contained in the antiglanders serum produced was found to be thermolabile, being destroyed by heating to from 55 to 60° C.

Channels of infection and localization in tuberculosis, C. H. HIGGINS (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 3, pp. 299-308).—From experimental data and cases reported it appears that under certain conditions tuberculosis may be merely a localized infection and the infection thus pass unnoticed even after a careful post-mortem examination. "It is quite apparent that the channel of infection governs to a large degree the localization of the lesions, and that infections observed in glands through which the lymph of an extremity or locality drains is a direct intimation that the infection has taken place in some locality from which the particular gland in question takes up its lymph supply."

It is noted that greater care should be taken in performing autopsies, and that more accurate records should be kept by all observers.

Tuberculin test and retest, C. J. MARSHALL and H. W. TURNER (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 3, pp. 308-337).—Data presented show that the best results were obtained when the retest was made about seven days after the original subcutaneous test and in conjunction with the ophthalmic test. Tuberculous animals were found to remain sensitive to tuberculin for a certain length of time after the original injection, the period, however, not being the same in all animals. The original injection of tuberculin is considered to sensitize the cells and make them more receptive to the retest tuberculin.

The authors recommend that in "herds in which there is no history of a previous tuberculin test, the ordinary subcutaneous test should be used on all animals over six months of age. Where 10 per cent or more of them react, a retest should be made with retest and ophthalmic tuberculin in from four to seven days. The semiannual subcutaneous testing of herds should not be continued, as too frequent tests lessen the sensibility of the animals to tuberculin and the reliability of the test to the owner. When a semiannual test is required the ophthalmic test only should be used. In animals under six months of age, the intradermal test should be used and where possible it should be combined with the ophthalmic or intrapalpebral test."

Making cattle environs free from infection eliminated by tuberculous cattle, J. TRAUM (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 3, pp. 289-299).—Results of experiments by the author, at the California Experiment Station, to determine the resistance of tubercle bacilli deposited on soil, the resistance when underground, and the resistance in water holes are reported.

The data obtained show that tubercle bacilli in feces and lung discharges do no longer produce tuberculosis in guinea pigs by inoculation when exposed in the dry season after three months, depending to a great extent, however, upon how soon the medium in which the bacilli are found is freed from moisture. The tubercle bacilli were found to remain alive in water for at least six months.

The effect of disinfectants upon the tubercle bacilli is briefly discussed, and some experimental results upon the specific effect of hypochlorite solutions are

the organisms reported. All the animals inoculated with the medium containing the organisms which had been treated with hypochlorite solutions developed tuberculosis. It is indicated that the evidence submitted, however, should be considered tentative until substantiated by further work.

Report of the committee on veterinary inspections and protection against tuberculosis of the American Association of Medical Milk Commissions, 1916-17, E. C. FLEISCHNER (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 3, pp. 268-288).—This report presents the results obtained from a questionnaire sent out by the committee to the secretaries of all the milk commissions in an endeavor to determine the conditions and activities of these commissions. Satisfactory replies were received from 32 (about 41 per cent) of the commissions. From 16 of the commissions replies were received which showed that the work carried on was either definitely unsatisfactory or that the function of the commission had ceased to be of value to the community.

The questionnaire and general results obtained are submitted and discussed in some detail, together with recommendations of the committee to the association.

Chronic arthritis in swine, S. SEKIGUCHI and E. E. ISONS (*Jour. Infect. Diseases*, 21 (1917), No. 6, pp. 526-540, pls. 2).—Of 21 cases examined hemolytic streptococci were found in 2, bacilli in 9, streptococci and bacilli in 4, no organisms in smears, sections, and cultures in 4, and in 2 cases bacteria were found in either smears or sections, which, however, failed to grow in cultures. Comparatively slight pathological changes were observed in most of the cases which did not yield any organisms at all or not in cultures. Pathological changes in the others are described.

A study of the bacilli isolated from the joints in some of the cases showed them to be culturally alike, and in morphology and most cultural reactions to resemble *Bacillus pyogenes* as described by Dutch and German veterinarians who isolated the organisms from cattle and swine. The bacilli obtained by the authors, however, did not liquefy gelatin and Loeffler's serum. "While the bacillary infection is apparently the etiologic agent in most of the cases included in this study, and the streptococcal infection apparently a later and secondary one . . . there may well be other organisms of suitable virulence which can set up similar processes. It seems important, however, to emphasize the element of nontuberculous infection in chronic deforming joint lesions in animals otherwise in good health."

Subcutaneous and intravenous inoculations of the bacilli produced lesions of the joints. "It is possible that puncture wounds of the skin in infected yards may be the means of initial infection in some instances. The alimentary tract can not be excluded, for in one case we found a marked chronic nontuberculous infection of the mesenteric lymph nodes associated with arthritis. . . . The occurrence of arthritis in some herds and not in others suggests local sources of infection on the affected farms. It would seem advisable to exclude from the hog lot any animals with chronic suppurations, whether swine, cattle, or other animals, for the same reasons that cattle and other animals suffering from tuberculosis are excluded to prevent tuberculosis among the hogs."

Cultural and inoculation studies of the streptococci isolated from the joint lesions were also made and are described.

Review of research work on hog cholera, M. DORSET (*Rpt. U. S. Live Stock Sanit. Assoc.*, 20 (1916), pp. 42-51).—From experimental work on the transmission of hog cholera the following general results are noted:

Results were obtained from which the author concluded that hog cholera is contagious at all stages, including the stage of incubation. Data obtained from some preliminary work showed that not all recovered pigs are cholera

carriers. Only two observations were made in this work, however, and it is indicated that no very definite conclusions can be drawn.

Other results showed that putrefaction may destroy the cholera virus. It was also shown that the usually accepted statement that hog cholera is invariably transmitted by attendants is doubtful.

In determining the period of infectivity of premises, it was found that in no case did susceptible pigs contract the disease in infected pens 24 hours after the removal of sick pigs. In one case the disease was contracted when exposure took place 6½ hours after the removal of sick pigs. In the concrete, wooden, and sandy floored pens, pigs which were exposed 1 hour after the removal of sick pigs contracted the disease, while in the pens which had sandy loam and clay floors the pigs remained well.

In determining the infectivity of excretions of cholera-infected hogs infectious before symptoms appeared, it was found that the blood and urine were both infectious on the first day after the injection of the hog, the feces on the second day, and the eye and nose secretions on the third day. No visible symptoms of the disease were observed until the fifth day, although there was a slight increase in temperature on the fourth day. It thus appears that the blood, urine, feces, and eye and nose secretions of cholera hogs may all be infectious before the animal exhibits any symptoms of the disease.

Increased virulence of the hog-cholera bacillus produced by passage through rabbits, C. TENBROECK (*Jour. Expt. Med.*, 26 (1917), No. 3, pp. 437-440).—The author has increased the virulence of a culture of the hog-cholera bacillus 1,000 times by passage through a series of 11 rabbits. A subcutaneous injection of 20 organisms, or 0.00000001 cc. of a 24-hour bouillon culture, or a drop of bouillon culture rubbed into the shaven skin produced a characteristic disease in the rabbit resulting in death on or about the sixth day.

The organism used in the work was isolated several years ago from the spleen of a pig which died from hog cholera. After isolation the organism was passed through a rabbit and has since been kept on slant agar in the cold, transfers having been made monthly. It is a motile, Gram-negative rod, growing readily on the ordinary media and forming acid and gas in dextrose bouillon but not attacking lactose or saccharose. It was quantitatively agglutinated by serum from rabbits injected with other strains of the hog-cholera bacillus, and when injected into animals caused the production of agglutinins for other strains of the hog-cholera bacillus.

The significance of agglutinins in the immunity of the rabbit to the hog-cholera bacillus, G. TENBROECK (*Jour. Expt. Med.*, 26 (1917), No. 3, pp. 441-451).—The results of the work reported indicate that "rabbits may show a high agglutination titer to the hog-cholera bacillus and have no immunity and, on the other hand, immune animals may have a comparatively low agglutination titer." With the organism used it is considered that the height of the agglutination titer does not indicate the degree of immunity.

Because of the similarity, biologically and pathologically, between the organism used in the work reported and the typhoid bacillus it is concluded that the degree of agglutination titer in man does not indicate the actual degree of immunity to the typhoid organism. The necessity of testing other organisms before a more general conclusion can be drawn is noted. "This does not mean that agglutinins are not related to immunity but it brings up the question of the wisdom of using them as a guide in immunization with the colon-typhoid group. When injected into the normal, vaccinated, or immune rabbit, the virulent hog-cholera bacillus is rapidly clumped and disappears from the circulation. Forty minutes after injection these organisms can be found in phagocytes in the liver."

Studies in forage poisoning.—V, A preliminary report on an anaerobic bacillus of etiologic significance, R. GRAHAM, A. L. BRUECKNER, and R. L. PONTIUS (*Kentucky Sta. Bul.* 207 (1917), pp. 47-113, figs. 36; *abs. in Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 6, pp. 748, 749; *Amer. Jour. Vet. Med.*, 12 (1917), No. 10, p. 702).—In an introduction to this bulletin A. M. Peter, acting director, briefly refers to the occurrence of forage poisoning in Kentucky and the investigations of it which have been conducted by the Kentucky Station. The present bulletin, which reports investigations carried on in continuation of studies which have extended over a number of years (E. S. R., 37, p. 689), deals with the isolation of a pathogenic anaerobic bacillus from an oat hay and the efficacy of an antiserum, prepared against *Bacillus botulinus*, in protecting animals against a disease having the characteristics of forage poisoning.

In the first part of the bulletin the authors review the present status of information relating to botulism in man and discuss the analogy of botulism to forage poisoning, the pathogenesis of *B. botulinus*, and its food requirements.

The investigations reported have been summarized by the authors as follows: "An oat hay which had caused a sporadic outbreak of forage poisoning retained its virulence in storage for approximately 22 months. The etiologic factor in this forage proved to be water soluble and capable of causing symptoms of forage poisoning and death in horses after freely drinking the water from the oat hay.

"*B. botulinus* proved fatal to horses and mules, subsequently to ingestion in wholesome feed, as well as by subcutaneous injection. The clinical symptoms and anatomic alterations accompanying artificial *B. botulinus* infection in horses and mules closely resembled the symptoms and gross anatomic lesions recognized in natural outbreaks of forage poisoning in central Kentucky.

"Chickens proved highly resistant to *B. botulinus* administered subcutaneously and by the mouth. The naturally voided excreta of fowls that had been fed *B. botulinus* proved fatal to a mule after ingestion, involving the domestic chicken as a possible agent in contaminating feedstuffs, should *B. botulinus* be prevalent in nature. This observation confirms Van Ermengem's original classification of *B. botulinus* as a toxic saprophyte and is in keeping with our observations upon an oat hay which proved to be contaminated with chicken feces. It has been previously reported in another paper [E. S. R., 34, p. 681; 36, p. 580] that chicken excreta from the oat hay in question, disguised in wholesome feed of a horse, caused symptoms of forage poisoning and death.

"Antitoxic goat, sheep, and cow sera, prepared against *B. botulinus*, proved efficacious against lethal amounts of a homologous toxin. The antitoxic serum afforded protection in horses when administered subcutaneously and intravenously, and in guinea pigs when administered intraperitoneally, against a fatal amount of homologous toxin by the mouth.

"*B. botulinus* can be cultivated in corn silage, alfalfa, and corn extracts, made slightly alkaline. In similar forage decoctions, made slightly acid, as well as in pork broth, *B. botulinus* can be propagated in association with *Fusarium* sp., under aerobic conditions.

"An anaerobic organism resembling *B. botulinus*, isolated from the cecum of a horse fatally infected after drinking water in which the oat hay in question had been immersed, proved fatal to horses, mules, and guinea pigs, administered by the mouth. The clinical symptoms and anatomic changes in horses experimentally infected with this organism proved to be indistinguishable from symptoms and gross lesions observed in horses as a result of feed-

ing *B. botulinus*. This organism was recovered from a horse after death following a fatal artificial infection. Antitoxic serum prepared against *B. botulinus* apparently provided protection in guinea pigs, administered intraperitoneally, and in horses, administered intravenously, against infection by the mouth with a lethal amount of the organism isolated from the cecum of [the horse referred to above]. The sterile broth culture filtrate of the organism isolated from this horse proved fatal to horses after ingestion. Antitoxic serum prepared against *B. botulinus*, administered intravenously, apparently afforded protection against lethal amounts of this filtrate.

"An anaerobic organism resembling *B. botulinus*, isolated from water in which the oat hay had been immersed proved fatal to horses, mules, and guinea pigs, when administered by the mouth. *B. botulinus* antitoxic serum administered intravenously and subcutaneously to horses and mules and intraperitoneally to guinea pigs, apparently provided protection in these animals against a lethal infection, per os, of the organism isolated from the water in which the oat hay had been immersed. The sterile filtrate from a broth culture of the organism isolated from the oat hay proved fatal to horses, after ingestion, and botulinum antitoxic serum, administered intravenously, proved efficacious in protecting horses against a lethal quantity of the filtrate, administered by the mouth.

"Several horses receiving prophylactic injections of *B. botulinus* antitoxic serum consumed water, for 30 days, from the barrel in which the oat hay was immersed without noticeable effect, at the end of which time a lethal amount of the organism isolated from the oat hay water was also consumed with impunity. In one horse antitoxic serum apparently did not afford protection against the oat hay water. For a period of 30 days three horses consumed the water in which the oat hay was immersed without noticeable effect, but succumbed after ingesting a lethal amount of the organism resembling *B. botulinus* isolated from the oat hay.

"The definite, morphological, cultural, and serological characters of the organism isolated from the experimental horse [previously mentioned] and of the organism isolated from the oat hay water closely ally them to *B. botulinus* and to our knowledge constitutes the first time this, or an allied anaerobic organism, has been definitely established as an etiologic factor in forage poisoning."

Studies in forage poisoning.—VI, An anaerobic organism isolated from silage of etiologic significance, R. GRAHAM, A. L. BRUECKNER, and R. L. PONTIUS (*Kentucky Sta. Bul.* 208 (1917), pp. 117-133, figs. 7).—This is a report of investigations of forage poisoning carried on in connection with those above noted. The present paper deals with studies made of an anaerobic organism isolated from corn silage during the course of an outbreak of forage poisoning in Carroll County, Ky., which resulted in the loss of a number of mules. The causative organism isolated from the silage was an anaerobic spore-bearing bacillus possessing morphological and cultural characteristics resembling those of *Bacillus botulinus*.

"In preliminary tests the unfiltered broth culture of this organism, administered by the mouth, proved pathogenic for guinea pigs and a mule. The filtered broth culture, administered by the mouth, proved fatal to guinea pigs, two horses, and a mule. A protection was provided by administering botulinum antitoxin to guinea pigs and horses against a lethal amount of the organism in broth or the sterile filtrate of broth culture of the organism in question. Serum immune to the bacillus isolated from the silage proved efficacious in protecting guinea pigs against a fatal artificial infection of *B. botulinus*, as well as against

the organism isolated from the silage. The agglutinins present in serum highly immune to *B. botulinus* were active to the organism isolated from the silage, thus contributing evidence of the possible relation of this organism to *B. botulinus*. Normal sera of different animals did not agglutinate *B. botulinus* nor the organism from the silage. Sheep serum immune to the organism isolated from the silage possessed agglutinating potency to *B. botulinus*, and to a similar pathogenic anaerobe isolated from a horse fatally afflicted subsequently to drinking water in which was immersed an oat hay obtained from a distant outbreak of this disease."

Repair of bone in the domestic fowl, B. F. KAUPP (North Carolina Sta. Tech. Bul. 14 (1917), pp. 3-17, pls. 11).—The author here considers the structure and development of the bones of fowls, the kinds of fractures and the reparative processes, and means of controlling the bird and care of the fracture. The studies consist of a series of 21 cases of fractures in the domestic fowl. It was found that at the end of the fifth day islands of bone tissue had begun to form. The repair of fractures in the domestic fowl is intramembranous. The periosteal, endosteal, and intermediary calluses show bone formation in trabecular-like arrangement. By the end of the thirteenth day the major portion of the bone tissue had formed and was found completed before the twentieth day. The appliance used to hold the broken bones in apposition in the domestic fowl may be removed with safety by the end of the twelfth or thirteenth day. The structure of compact bone in the domestic fowl is similar to that of mammals."

Life history of *Ascaris lumbricoides* and related forms, B. H. RANSOM and W. D. FOSTER (U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 8, pp. 461-498).—The investigations of Stewart (E. S. R., 37, p. 374) having shown that the embryos from *Ascaris* eggs fed to rats and mice hatch out in the alimentary tract and migrate to the liver, spleen, and lungs, in the course of which they pass through certain developmental changes, and regain the alimentary tract by the way of the lungs, trachea, and esophagus, resulting in pneumonia in many of the infested animals, led the authors to conduct the experiments here reported. The results obtained and the deductions drawn therefrom are summarized as follows:

"The development of *A. lumbricoides* and closely related forms is direct, and no intermediate host is required. The eggs, when swallowed, hatch out in the alimentary tract; the embryos, however, do not at once settle down in the intestine, but migrate to various other organs, including the liver, spleen, and lungs. Within a week, in the case of the pig *Ascaris*, the migrating larvæ may be found in the lungs and have meanwhile undergone considerable development and growth. From the lungs the larvæ migrate up the trachea and into the esophagus by way of the pharynx, and this migration up the trachea may already become established in pigs, as well as in artificially infected rats and mice, as early as a week after infection. Upon reaching the alimentary tract a second time after their passage through the lungs, the larvæ, if in a suitable host, presumably settle down in the intestine and complete their development to maturity; if in an unsuitable host, such as rats and mice, they soon pass out of the body in the feces.

"Heavy invasions of the lungs by the larvæ of *Ascaris* produce a serious pneumonia which is frequently fatal in rats and mice and apparently caused the death of a young pig one week after it had been fed with numerous *Ascaris* eggs."

"It is not improbable that ascarids are frequently responsible for lung troubles in children, pigs, and other young animals. The fact that the larvæ

invade the lungs as well as other organs beyond the alimentary tract and can cause a serious or even fatal pneumonia indicates that these parasites are endowed with greater capacity for harm than has heretofore been supposed.

"Age is a highly important factor in determining susceptibility to infection with *Ascaris*, and susceptibility to infection greatly decreases as the host animal becomes older. This, of course, is in harmony with the well-known fact that it is particularly children and young pigs among which infestation with *Ascaris* is common, and that *Ascaris* is relatively of rare occurrence in adult human beings and in old hogs."

In a footnote the authors call attention to the fact that later experiments with guinea pigs have shown that they also may be infected by feeding *Ascaris* eggs, and that the migration of the larvæ in this animal so far as observed is identical with that noted by Stewart in rats and mice. All of six guinea pigs infected died from pneumonia seven and eight days after feeding with *Ascaris* eggs, the lungs being found heavily infested with *Ascaris* larvæ.

RURAL ENGINEERING.

The waters of the Rio Grande, W. P. HEADDEN (*Colorado Sta. Bul.* 239 (1917), pp. 3-62).—This report states that the Rio Grande flows for about 60 miles through the San Luis Valley without any considerable change in the character of its waters, the flow diminishing rather than increasing. "There are only a few streams having a visible discharge into the Rio Grande. The drainage is practically out of the Rio Grande into the valley. . . .

"The ground waters of the valley retain the characters of the mountain waters in a noteworthy degree, and . . . have their own characteristics, which are pronounced enough to affect those of the Rio Grande water if any significant volume of them is mingled with it. The alkalis, that is, salts that collect in the surface portions of the soil or appear as efflorescences, are of three types. These types are (1) plain sulphates, soda and lime being the predominant bases (this type is the predominant one); (2) sulphates and chlorids (this type is not abundant though it is well distributed); and (3) a type in which sulphates and carbonates occur (the occurrence of this type is for the most part confined to the area north of the Rio Grande). Solutions of these alkalis do not find their way into the Rio Grande in sufficient quantities to noticeably modify the composition of its water.

"The valley is an exceedingly large artesian basin, but the waters are of two characters. Those of the southern portion and the rim of the basin are white and carry an excess of acids. Silicic is especially high, while those of the northern interior portion of the basin are alkaline and usually brownish or brown in color. The white artesian waters, especially those flowing from shallow wells, from 75 to 300 ft. or even more, are very similar to river or mountain water and would simply increase the volume and would not change the character of the river water if they mingled with it.

"The brown water is free from silicic acid and contains as good as no salts except sodic carbonate. This character of the brown waters is the same for all flows from the shallowest to the deepest examined, 880 ft. The deeper flows increase in the amount of salts held in solution without any change in their character. This increase was from 22 to 108 grains in each imperial gallon. These waters would change the character of the river water if they mingled with it, which they appear not to do. The brown color is accidental and is due to peaty material dissolved out of the aquifers themselves. . . .

"The sodic carbonate is considered as originally coming from the mineral constituents of the rocks furnishing the sands and clays that form the strata

now composing the floor of the valley. The changes necessary to remove the silicic acid and lime from the mountain waters are simple. The small concretions of calcic carbonate met with in the sand from the strata passed through at 550 ft. indicate simple precipitation as the method of removing the lime.

Evaporation alone is considered adequate to account for the concentration of the sodic carbonate that we find in this section. Evaporation at the present time is sufficient to add 145,500,000 lbs. of sodic carbonate to this section of the valley yearly. This is on the supposition that the mountain water carries 2.5 grains of sodic carbonate in each imperial gallon, or 10 lbs. of water evaporated.

"The present agricultural condition of this section of the valley is due to the accumulation of this salt, black alkali, rather than to an excess of water. Local surface drainage is necessary in many small localities. The evaporation from the area involved is equivalent to an inflow of 2,000 sec.-ft. throughout the year. This is probably a larger amount than this section of the valley actually receives, except for a very short period in the spring of the year when the direct overland inflow may equal or possibly exceed this amount.

"The San Luis Lake water is peculiar in its composition and unlike either the river, ground, or artesian waters. The deposit of sodic carbonate east of the San Luis Lake is probably derived from the evaporation of the brown artesian water, and has no connection with the lake. The conditions which have determined the character of the brown artesian waters are still active in determining the agricultural features and questions of this section of the valley. The question of black alkali in this section is in places further involved by the occurrence of nitrates. The conditions which obtain and are inimical to vegetation can be ameliorated by rational irrigation, chemical treatment of the soil, and surface drainage where needed."

Run-off from the drained prairie lands of southern Louisiana, C. W. OKRY (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 6, pp. 247-279, figs. 5).—Investigations on the relations between the rainfall and the amount of water that it is necessary to pump from 10 typical drainage districts in order to secure a degree of drainage that will allow the growing of ordinary field crops are reported. The districts vary in area from 647 to 7,500 acres and the details of soil, crops, surface slope, and character of the drainage channels and levees are different on each district. A brief description of each district is given together with a brief summary of conditions prevailing during each year covered by the records. The results of the investigations are graphically reported. "It is evident that the effect on the run-off of a change in the capacity of the pumping plant can not all be measured by the change of level of the water in the main reservoir channels, as greater slope and velocity of water occur in the drainage channels when a larger pumping plant is installed. This effect extends even to the small field ditches.

"In estimating the run-off likely to result from an assumed storm on a given district the curve used should be that for the district which resembles the given district in area, pumping-plant capacity, reservoir capacity, and general conditions. The curves may be considered only as representing general tendencies and not definite values. They should be of service, however, in making the proper adjustment between reservoir and pumping-plant capacity. . . . It is believed that, in general, after a capacity of about 0.5 in. of water over the area drained has been provided in the main reservoir channels between the surface and a level 5 ft. below it will be cheaper to obtain increased capacity to handle storms by enlarging the pumping plant rather than the reservoir.

This will depend, however, on local costs for excavation and pumping machinery.

"In determining the proper combined capacity of the pumping plant and reservoir the main factor to be considered is the amount of rainfall in an assumed period for which provision is to be made. . . . As the accompanying curves were prepared with data from storms which occurred when the land was wet, a determination has been made of the proportion of storms which occur when the land is wet. Of all the storms of over 2 in. in 24 hours which have occurred on the districts during the time covered by the records, 64 per cent occurred on a wet and 36 per cent on a dry surface; of all storms over 4 in. the percentages are 54 per cent and 46 per cent, respectively. Of course, the storage capacity of the land influences the run-off from the small storms relatively much more than it does that from the large ones. However, an examination of the daily rainfall and pumping records will show that heavy rains on a dry soil do not make very heavy demand on the pumping plant. It is believed, therefore, that a reduction of about 30 per cent in the average frequency of storms could be made safely and that the resulting figure would be the proper one for use. If the character of operations that are to be conducted on the land of a given district is known, a decision can then be made as to the heaviest storm for which provision must be made. On a district where staple crops are to be raised it would be economical to allow a certain amount of flooding oftener than would be advisable on land where high-priced truck crops are to be raised, while in residence districts it would be very desirable to prevent all surface flooding. In addition to the damage to crops due to flooding, there are other factors to be considered, such as inconvenience to residents and the possible depressing influence on land values of floodings occurring even at infrequent intervals."

Effect of pumping from a shallow well on the ground-water table, W. W. WEIR (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 7, pp. 339-357, Ags. 16*).—Experiments conducted at the Kearney Park farm under the supervision of the California Experiment Station, in cooperation with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture, are reported on the effect of pumping from a shallow well on the ground-water table and its relation to the drainage of irrigated lands.

"The results of this experiment lead to the conclusion that under soil, irrigation, and farming conditions such as are found on the Kearney Park . . . tract pumping from a shallow well does not lower the ground-water table sufficiently to afford drainage to any considerable area. In this experiment, although the water table in the sump was maintained at a depth of about 12 ft below the ground surface and from 5 to 7 ft. below the normal ground water, the effect of the pumping was not appreciable beyond 100 ft. from the pump. Except within a very short distance from the pump, the ground water rose to a point as near the ground surface in 1915, while the pump was in operation, as it did in 1914, when no pumping was done. Seasonal variations are great enough to account for any differences observed.

"Contrary to the results obtained here, it has been found that the water table can be materially lowered by the use of tile drains for greater distances away from the drain than is shown in this experiment. . . . The fact that tile drains have proved more efficient than pumping from a well in lowering the ground-water table is due, no doubt, to the much larger area reached by the tile. . . . Thus, with such a system any lateral movement of water is more readily intercepted, and any vertical pressure is relieved at more points than is possible where tile is not used, even though the water table is maintained at a greater depth in the well than is done by the tile lines. It would appear.

therefore, from the results of these experiments that, although it has been proved feasible to reclaim water-logged land by means of tile drains, it would not be practicable to locate wells and pumping plants similar to the one described . . . close enough together to lower the water table over any considerable area or develop enough water for practical farm irrigation without storage.

—It is doubtful if the results of this experiment would have been materially different had it been located on the more poorly drained areas."

Farm drainage in Virginia, C. E. SERTZ (*Vo. Polytech. Inst. Ext. Bul. 15* (1917), pp. 35, pl. 1, figs. 18).—This bulletin gives general but practical information on the planning and construction of tile drains and drainage systems, with special reference to Virginia conditions.

Irrigation works constructed by the United States Government, A. P. DAVIS (*New York: John Wiley & Sons, 1917, pp. XVI+413, pl. 1, figs. 128*).—It is the object of this work to give engineering descriptions of the U. S. Reclamation Service works together with illustrations. Chapters are included on the Salt River, Yuma, Orland, Grand Valley, Uncompahgre, Boise, Minidoka, Huntley, Lower Yellowstone, North Platte, Truckee-Carson, Carlsbad, Hondo, Rio Grande, Umatilla, Klamath, Belle Fourche, Strawberry Valley, Okanogan, Yakima, and Shoshone projects.

Reservoir capacity for small pumping plants, S. T. HARDING (*Jour. Electricity, 39* (1917), No. 4, pp. 170-172, figs. 2).—Curves of data are given on capacity of reservoirs required to maintain rates of discharge varying from 100 to 1,000 gal. per minute for periods varying from 6 to 96 hours, and also curves giving data on discharge of reservoir outlets for pipe sizes varying from 6 to 24 in. and head losses through outlets varying in size from 0 to 18 in.

Longevity of *Bacillus coli* in water, F. L. RECTOR and H. J. DAUBE (*Abstr. Bact. 1* (1917), No. 1, p. 57).—Sterile 1-liter bottles were filled with distilled water, tap water, and a bottled water and tested for *B. coli* with negative results. Each bottle was then inoculated with 0.5 cc. of a 24-hour broth culture of *B. coli*, plates being poured immediately and daily thereafter until negative results were obtained. Litmus lactose agar plates were used.

One day after inoculation there was a marked increase in the number of *B. coli*, but subsequent examinations showed a gradual and regular decrease which resulted in the final disappearance of the organism from the bottled water in 25 days and from the tap water and the distilled water in 48 days. By cultivating in dextrose liver broth the organism was found to be present in 50 cc. quantities in the bottled water until the thirty-sixth day, in the distilled water until the fifty-seventh day, and in the tap water until the sixty-fourth day.

Mechanical grading of concrete sand, O. R. SMITH (*Concrete [Detroit, Mich.], 11* (1917), No. 3, pp. 76, 77, figs. 5).—Tests are reported from which it was concluded that "the most dense and strongest mortar for concrete work is obtained if the sand has the following granulometric composition: "One-fourth in. sieve, residue none; No. 10 sieve, residue 60 per cent; No. 20 sieve, 80; No. 30 sieve, 85; No. 50 sieve, 90; and No. 100 sieve, from 95 to 98 per cent.

Motor gasoline: Properties, laboratory methods of testing, and practical specifications, E. W. DEAN (*U. S. Dept. Int., Bur. Mines Tech. Paper 166* (1917), pp. 23, pl. 1; *abs. in West. Engin.*, 8 (1917), No. 8, pp. 316-319, fig. 1).—This pamphlet enumerates the desirable properties of gasoline and discusses types of gasoline marketed and the relative value of various tests used.

Specific gravity in itself is of very slight significance in determining the properties of gasoline. It may serve as an index of other properties, particularly volatility. If knowledge is at hand regarding the source and method of production of a gasoline. The determination of gravity has been and probably always

will be one of the most useful tests that the refiner employs, but it is of but little value to the analyst who does not possess sufficient additional information to make proper interpretation of gravity results. . . .

"Volatility is the basic property that determines the grade and usefulness of a gasoline. . . . General consideration of the numerous factors involved has led to the following conclusions regarding the desirable characteristics of the volatility of motor gasoline: Gasoline should contain a moderate but not excessive proportion of low-boiling constituents, enough to permit easy starting of a cold engine but not enough to make evaporation losses excessive. Gasoline should have a total volatility range wide enough to include constituents that have a high, but not too high, boiling point. For economic reasons affecting both the individual user and the country as a whole, this volatility range should be such that the gasoline contains the largest possible percentage of the original crude oil. It should not, however, be wide enough to exceed the limits of the vaporizing power of the automobile engine."

In the proposed specifications for motor gasoline it is required that the color be water white and that acidity be totally absent.

"The gasoline shall, when distilled by the method described, meet the following requirements: (1) The temperature read on the thermometer when 20 per cent has distilled shall not be below 70° C. (158° F.) nor above whatever limit is fixed after due consideration of conditions of use. (2) The temperature read when 90 per cent has distilled shall not be above another limit similarly chosen. (3) The temperature read when 50 per cent has distilled shall not be higher than a mark half way between the 20 per cent and the 90 per cent limit. (4) The dry point shall not exceed the actual 90 per cent reading by more than 55°."

"Tolerance.—If either the 20 per cent or the 90 per cent temperature mark is above the required limit by an amount not exceeding 10°, the gasoline may be considered acceptable if the sum of the two temperatures read for the 20 and the 90 per cent marks do not exceed the sum of the adopted limits."

Distillation methods and apparatus are described and specifications given therefor.

Tractor facts for Oklahoma farmers (*Oklahoma City, Okla.: Oklahoma Farmer, 1917, pp. 37, figs. 49*).—This is a brief summary of information, favoring the use of the tractor on Oklahoma farms.

Harvesting and plowing simultaneously with a tractor, M. RINGELMANN (*Bul. Soc. Encour. Indus. Nat. [Paris], 116 (1917), I, No. 3, pp. 595-599, figs. 2*).—The details of this procedure as practiced under French conditions are described. Experiments in 1916 showed that a hectare (2.47 acres) of grain could be harvested and bound and the ground plowed in 2 hours and 36 minutes at an expense for the tractor of about 26.54 francs (\$5.12).

Handling silage, L. W. CHASE (*Univ. Nebr., Col. Agr. Ext. Bul. 45 (1917), pp. 16, figs. 14*).—Devices for harvesting, hauling, unloading, cutting, placing and removing silage are described and illustrated, with particular reference to pit silos under Nebraska conditions.

Utilizing exhaust steam for heating water and for pasteurizing (*U. S. Dept. Agr., Bur. Anim. Indus. Milk-Plant Letter 43 (1917), pp. 2*).—This is a mimeographed letter in which attention is called to the value of exhaust steam from milk plants for pasteurizing and heating boiler feed water. Data are also given showing how the coal bills of different plants vary according to the plant efficiency.

"The heating of feed water from 50 to 200° F. by the use of exhaust steam will directly reduce the fuel consumption by about 13 per cent. The actual saving in fuel, however, is greater than that, owing to the more even firing

In addition to the saving in fuel the life of the boiler is prolonged on account of the avoidance of expansion and contraction strains set up in the boiler shell through the feeding of cold water. For every 10° the feed water is heated by exhaust steam before it enters the boiler, approximately 1 per cent of the fuel is saved. . . .

To heat 300 gal. of milk from 60 to 145° requires about 30 lbs. of coal, so that with that amount of milk an exhaust steam heater would effect an annual saving of more than 5 tons of coal. . . . If 1,000 gal. of milk is heated from 145 to 75°, 573,800 B. t. u. are added to the water. Assuming coal at 12,500 B. t. u. per pound and boiler and furnace efficiency of 50 per cent, the saving of the heat is equivalent to saving 92 lbs. of coal."

Farm potato storage in North Dakota. H. O. WEENER and P. E. CLEMENT (*N. Dak. Agr. Col. Ext. Bul. 11 (1917), pp. 12, figs. 6*).—This bulletin describes and illustrates potato storage cellars which have been found efficient and moderate in cost in North Dakota.

Silos. F. M. WHITE (*Univ. Wis. Agr. Ext. Serv. Circ. 87 (1917), pp. 24, figs. 17*).—General information regarding the planning of wooden and concrete silos is given in the form of questions and answers.

Running water in the farm home. C. E. SEITZ (*Va. Polytech. Inst. Ext. Bul. 19 (1917), pp. 11, figs. 3*).—This is a brief popular bulletin describing well-known plans for obtaining running water in the farm home, but including bills of materials and cost data of special value to Virginia farmers and agricultural engineers.

RURAL ECONOMICS.

Important factors in the operation of irrigated Utah farms. E. B. BRONKARD (*Utah Sta. Bul. 160 (1917), pp. 48, figs. 16*).—This investigation is based upon the 1914 farm business records of 309 irrigated Utah farms. Among the conclusions brought out were the following:

A greater percentage of capital is directly productive on farms with large capital than on farms with small capital. There is less waste land in proportion to the total farm area on the farms with large capital. Farms with large capital are more profitable than farms with small capital, as shown by the increase in labor income. This increases in the same ratio as farm capital until capital reaches \$20,000 or over, but beyond this as capital increases 1 per cent, labor income increases only about 0.33 per cent. There are more acres of crops, on the average, on the large farms than on the small farms, but the proportionate area cropped is less. Horse and man labor with crops and live stock is more efficient on the large farms.

Over half of the labor income from the average irrigated Utah farm is increase in inventory of farm capital, and the most important increases in the farm inventories are in live stock and feed, which seems to indicate that Utah farmers realize the advantage of increasing the number of live stock on their farms. On an average the farms with the highest crop yields per acre are the most profitable. When average crop yields are maintained, the size of the irrigated Utah farm influences the labor income of the farmer more than increased crop yields per acre. The number of live stock and the net live stock receipts per productive animal unit affect directly the farmer's labor income—as either increases the farmer's labor income increases, and both are important factors in the operation of irrigated Utah farms.

The dawn of a new constructive era (*Proc. Cut-Over Land Conf. South. 1917, pp. 244*).—This is the report of a conference held in New Orleans, La., to discuss the cut-over land problem of the South, and devoted primarily to

considering various methods that might be used to bring the cut-over land into agricultural use.

Agricultural wages in Sweden, 1915, B. NYSTRÖM and J. G. RICHERT (*Stockholm: K. Soc. Styr., 1916, pp. 39*).—In this report are given for 1915 the systems of paying for work and the wages by types of work performed and whether on the yearly or daily basis. The information is also given by sex and for minor subdivisions.

[Data relating to agricultural contracts, 1914] (*Finlands Off. Statist., XXX, No. 5 (1916), pp. [4]+32+15*).—In this report data are given regarding laws and contracts relating to wages and labor under the old and new systems, and also to the rent and leasing of land, buildings, and forests. The data relate mainly to the renting of small farms and give the areas under various types of leases.

The high cost of living, F. C. HOWE (*New York: Charles Scribner's Sons, 1917, pp. X+275*).—The author has discussed the high cost of living as it is dependent on the influence of the buying and selling of wheat in exchanges, the system of marketing live stock, cold storage, transportation, value of land, and the withholding of land from agricultural use. He also calls attention to the organization of the agricultural interests in Austria, Germany, Denmark, and Australia, and its effect upon prices and systems of agricultural practices.

Report of the committee on warehousing and storing of sugar, for the year ending September 30, 1917 (*Hawaii. Sugar Planters' Assoc., Rpt. Committee Warehousing, 1917, pp. 67*).—The authors include in this report information received from plantation managers as to the methods of warehousing and storing sugar, types of flooring and building, how ventilated, location with reference to the ocean trade-winds, percentage of the total crops which can be warehoused in an emergency, influence of methods of manufacture, influence of heat-resisting ferments on the keeping qualities, weighing automatically or by hand, methods of sewing bags, mechanical means of piling sugar in warehouses, and loss in weight in shipping to San Francisco and to New York.

Cold storage in Canada, W. F. O'CONNOR (*Ottawa: Govt., 1917, pp. 63*).—In this report are discussed cold storage conditions in Canada, indicating the classes and character of cold storage establishments, including abattoirs, and the margins of profit for 1916-17. The author concludes that the operations of cold storage companies generally have been fairly conducted and that the margins of profit have not as a rule been so high as during 1916. He points out that any reduction secured by lessening these margins would go only a short way toward lessening prices to consumers.

Cooperative marketing of eggs in Florida, MINNIE M. FLOYD (*Fla. State Col. for Women Ext. Bul. 16 (1917), pp. 27, figs. 12*).—The author discusses the methods of candling and marketing eggs, community egg circles, rules to be followed by producers in assembling, shipping, and finding customers. A model by-law and a constitution to be used by community egg circles are included.

Uniform cost accounting for milk distributors, E. A. KRACKE (*Jour. Accountancy, 24 (1917), No. 6, pp. 424-429*).—The author discusses the factors to be considered in estimating the cost of milk distribution, such as sizes of bottles, classes of trade, system of delivery, and whether the monthly or annual cost is desired.

The community fair, J. S. MORAN (*U. S. Dept. Agr., Farmers' Bul. 879 (1917), pp. 11, figs. 8*).—The author explains that "the community fair is a miniature county fair with the races, side shows, and other commercialized amusements omitted. It calls not only for the exhibition of the best products

that have been grown and the best work that has been done in the community, but also for games, athletic contests, pageants, and similar features of recreational or educational value. The community fair is most effective where the whole community is concerned in its management, though successful fairs, patronized by the greater part of the people of the community, are often held by the Grange, Farmers' Union, or other farmers' organizations."

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 3 (1917), No. 11, pp. 105-116, figs. 4*).—This contains a crop summary for November, 1917, and the usual estimate of crop conditions, estimate farm value of important products, average prices received by producers, and range of prices of agricultural products at important markets. In addition, there are shown data regarding the crop conditions in Florida and California, prices of alfalfa and clover seed, crop production and consumption, exports from the United States of leading cereals, potatoes, and meats, the frost damage to corn, the percentage of farm labor hired by the month and by the day, with and without board, the commercial acreage and production of cabbage, monthly movement of wheat from farms, crop prices and production, honey production in 1917, pecan production, a potato forecast by months, monthly wheat prices, wheat prices in England from 1250, etc.

Exports of raw cotton from the United States (*New York: National Bank of Commerce, 1917, pp. 13*).—This report discusses exports of cotton from the United States to the leading European neutrals, endeavoring to point out to what extent Germany has been able to obtain cotton by this means.

Economical notes on Brazil (*Rio de Janeiro: Min. Agr., 1916, 2. ed., pp. 93*).—This report contains discussions of the foreign trade in agricultural products for 1910-1914, and of the industries using agricultural products, the cattle industry, and immigration. The report contains a large amount of statistical data relating to the various topics treated.

Acreage under crops and the numbers and descriptions of live stock in each county and province of Ireland, 1916-17 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis., 1917, pp. 29*).—By adding data for a later year, this report continues the information previously noted (*E. S. R., 36, p. 404*).

Agricultural statistics of Netherlands (*Dept. Landb., Nijr. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 3 (1917), pp. 132+XCI, fig. 1*).—This report gives data for 1916, with comparisons for earlier years, showing the acreage, yields, number of live stock, business of the credit organizations, insurance societies, extent of business conducted by rural banks, prices, imports and exports, and discusses the weather and crop conditions and crop prices.

Agricultural statistics of France (*Ann. Statis. [France], 34 (1914-15), pp. 142-181*).—This continues data previously noted (*E. S. R., 34, p. 201*) giving statistics for later years.

Live stock statistics, P. VAN HISSENHOVEN (*Internat. Inst. Agr. Rome, Internat. Crop Rpt. and Agr. Statis., 8 (1917), No. 10, pp. 808, 809*).—Statistical data are given showing the number of various classes of live stock on July 1, 1917, for Denmark, and on July 1, 1917, for France.

Agriculture in Babira, Belgian Kongo, LACOMBLEZ (*Bul. Agr. Congo Belge, 1917, No. 1-2, pp. 52-72, figs. 9*).—In this article are described the population, soils, vegetation, methods of communication, and native crops of this district.

Agricultural statistics of Australia for 1905-06-1915-16 (*Commonwealth Bur. Census and Statis. Aust., Prod. Bul. 10 (1917), pp. 168*).—By adding information for later years, this report continues the data previously noted (*E. S. R., 27, p. 595*).

AGRICULTURAL EDUCATION.

The scope of home economics and its subject matter in universities and colleges, ALICE RAVENHILL (*Jour. Home Econ.*, 9 (1917), No. 9, pp. 393-404, fig. 1).—The author offers comments and suggestions as to results which should have been attained after 40 years of widespread teaching in home economics and the reasons likely to account for the slow permeation of public practice by the teachings of home economics. In her opinion the latter may be due in part to an oversight of the fact that home economics is among the numerous contributory subjects of hygiene, and that too a large percentage of home economics students fail to grasp that the primary object is the promotion of health—physical, mental, and moral. Instead, their chief purpose has been rather the production of more economical yet equally attractive food, clothing, and shelter than hitherto. There has also been an omission on the part of graduates to assume a sufficiently influential position in social and civic life to diffuse by example and standard the tenets they profess.

In a comparison of the values assigned to the three main subdivisions of food, clothing, and shelter, and to household administration, it is found that less prominence is assigned to the last-named, although it actually contains the kernel of the whole course. It is suggested that the methods, whether in library, laboratory, or classroom, be reconsidered to the degree that fewer hours would be spent in future college courses in the actual preparation of food or in the mere setting of stitches. No attempt at what is usually miscalled "research" would be permitted except for postgraduate students. Standards of attainment would no longer be estimated by hours, but personal hygienic practice, the responsibilities of parenthood, the physical as well as the psychological development of children, the social and civic relations of the home must all receive more definite, more extended, and more suitably coordinated treatment than is at present the rule. The part played by the husband and father in family welfare must also be more accentuated. Much closer coordination must be cultivated between the divisions of home economics departments than is usually found. There should be no broad line of demarcation between what is described as household science and household art.

While specialization is necessary for the expert, such as the college and university teacher, it is deemed prejudicial to the student whose goal is family and institutional management, because it has a tendency to exaggerate a nonexistent distinction between so-called science of foods and the arts of clothing or shelter. A revision and rearrangement of some of the subject matter might also be of advantage. Further, the development of a higher standard in the broad cultural and historical aspects of the subject of hygiene and home economics in those who are in charge of these courses would foster that sense of perspective, that perception of the relation of the parts to the whole which maintains balance and adds technique and responsibility to the course.

The relation of home economics education to social hygiene, J. H. FOSTER (*Jour. Home Econ.*, 9 (1917), No. 9, pp. 405-411).—The function of social hygiene as a protector of family and home brings it close to home economics education, at least in its broader sense as the author conceives the purposes and ends of such education. The opportunity of the home and school in social hygiene is briefly outlined.

Public instruction in cookery in London, K. MERRILL (*U. S. Dept. Com. Rpts.*, No. 270 (1917), pp. 666-668).—The author calls attention to the present stimulation of instruction in cookery in and around London by the necessity for a certain amount of training for all housewives along the lines of economic cooking of war foodstuffs. In addition to the institutions charging tuition, a traveling motor-car kitchen maintained by the London County Council is available for the working-class people. This gives in each place six

demonstrations, a week apart, according to a prescribed syllabus including such subjects as substitutes for meat, wheat flour, sugar, catering for a week, kitchen economies, fuel-saving devices, etc.

To fill the needs for training in domestic economy for times of peace, the council has provided courses in cookery, laundry work, and housewifery in both day schools and evening institutes. Children between the ages of 5 and 14 years are required to attend these schools and the course in domestic science is taken in the last two years of their attendance. One-half day each week is devoted to the subject, although in certain districts pupils are withdrawn, either entirely or at least half the week, from school duties during a period varying from three to six months in their last year at school, so that they may pursue the domestic work under as realistic conditions as possible. In January, 1917, the 178 cookery centers, 56 laundry centers, 128 combined cookery and laundry centers, and 72 housewifery centers provided places in all for 65,500 children. The evening institutes are attended by persons of all ages from 14 to 60. Their plan of teaching is elastic and the subject is never considered of more value than the development of the economic power of the individual. Special courses of lessons may be arranged for war-time meals.

Various polytechnic institutes, supported by the authorities and the reasonable tuition fees, supply finishing and advanced courses in all subjects of domestic science. They require for entrance a thorough grounding in the elementary subjects. Special courses of wide range are provided in trade subjects for apprentices or domestics who can attend only at night.

Scholarships in cookery are provided for candidates between the ages of 17 and 35 years who have been in domestic service at least 1 year, providing 12 weeks' instruction under a qualified chef, a meal every school day, and about \$25 toward travelling expenses. In order that a proper perspective may be maintained through the whole instruction, a free course in experimental science is given in connection with the cookery classes.

Federal aid for vocational education: A report to the Carnegie Foundation for the Advancement of Teaching, I. L. KANDEL. (*Carnegie Found. Advanc. Teaching Bul. 10* (1917), pp. VI+127).—Part 1 of this bulletin presents a legislative history, based on the discussions in the *Congressional Record*, of the acts of Congress of 1862, 1890, and 1907, for the establishment and development of colleges of agriculture and the mechanic arts, and of the agricultural experiment station appropriations of 1887 and 1906. It is alleged that there was an absence of any serious educational program in this legislation, either on the part of Congress or Senator Morrill himself.

Part 2 comprises studies of precedents for Federal aid for education and of the constitutional authority of Congress to dispose of public lands for educational purposes, and a brief history of the movement for Federal aid for agricultural education in this country and of higher agricultural education in Europe up to 1851. The author contends that (1), "the recognition of the value and importance of agricultural and industrial education was already widespread when Senator Morrill became associated with the movement; and (2), that the advocacy of Federal aid in support of this type of education had been persistent for a number of years before the act of 1862 was passed."

Part 3 discusses the subsequent legislative developments, taking up the Agricultural Extension Act of 1914 and the Federal Aid Vocational Education Act of 1917. The author maintains that "the one large experiment in the provision of Federal support for education, the Morrill and supplementary acts, failed for nearly 40 years, and the failure was due to the absence of an educational policy. Only when the States really took up the objects, and only when a general social demand arose, was success possible."

Statistical data showing the whole number of graduates in branches relating to agriculture, mechanic arts, and science and classics in the land-grant colleges in 1872-73, the distribution of students in land-grant colleges in 1894-1914 in agriculture and mechanic arts, the percentage of total distribution of the expenditures of the land-grant colleges from 1903-1915, income of land-grant colleges according to sources from 1892-1915, and Federal aid now available to the colleges under the various acts are included, as well as tables presenting the development of the curriculum of three agricultural colleges (Pennsylvania, Michigan, and Illinois) at approximately 25-year intervals.

"The vagueness of aim during the first 30 years following the passing of the Morrill Act is well brought out by the uncoordinated mass of subject matter, for which it would be difficult to find justification in the philosophy of education or in the practical needs of the agricultural profession. The tendency since 1890 has been toward differentiation and specialization. Much has been eliminated that was not pertinent, a better conception has been formed of the cultural needs of the agricultural specialists, and finally, the practical and scientific needs of the farmer have been well coordinated. The modern agricultural college presents not merely an array of subject matter that was impossible before the development of the sciences on which agriculture depends, but a large number of specialized courses."

An introduction to the bulletin by H. S. Pritchett, president of the Carnegie Foundation, contains a serious arraignment of the policy and results of Federal aid to agricultural education. He declares that "it is not too much to say that for the first 50 years of their existence the colleges thus established did very little to advance the interests of agriculture or to minister to the needs of the young men and young women on the farm. It is only within the last few years that they have addressed themselves directly to this problem."

State-aided vocational education: A résumé of ten years' progress. [Statistics of vocational education] (*Ann. Rpt. Bd. Ed. [Mass.], 80 (1915-16)*, pp. 128-165, 261-301).—A 10-years' résumé of vocational education in Massachusetts includes the conclusions of the Douglas Commission on Industrial and Technical Education in 1906 and comments thereon in 1916. Public vocational education of secondary-school grade in Massachusetts may be claimed to be the result of the report of this commission. It considered the problem of vocational education from the side of the industries and the adult workman and from the side of the children who were to enter the industries of the State.

The article also reports on the present status of State-aided vocational education and home economics training in Massachusetts. The agricultural education is being given by 3 county vocational agricultural schools, a separate agricultural day school, at Northampton, doing the same type of work and receiving State aid under special acts of the legislature, and 15 agricultural departments in connection with high schools and academies. In Norfolk County the board of education is maintaining a central agricultural school of moderate size (established in 1915-16), and supporting it at the most distant points in the county by branches consisting of 1-teacher agricultural departments in high schools. In 1915-16 the total enrollment in the separate schools was 274, including 30 nonresidents, and in the departments, 223 students including 74 nonresidents.

By the provisions of an act of the 1916 legislature, 36 cities were authorized to maintain schools of agriculture and horticulture for families and individuals, the instruction being subject to the approval of the State Board of Education. The board believes that vegetable and fruit growing, poultry keeping, and possibly the production of milk and honey may be taught families not by book or lecture method, but by personal instruction and supervision.

The total earnings of vocational agricultural students in the agricultural schools and departments from farm and other work during the periods covered by their school attendance and their farming projects have increased from \$11,100 in 1912 by a total of 70 pupils, in 3 schools and 10 departments, to \$4,173 by a total of 497 pupils in 3 schools and 13 departments in 1916. The total outlay for State-aided vocational education was \$1,632,379; net maintenance, \$2,350,088; and reimbursement, \$1,315,946. This includes for agricultural schools an outlay of \$266,708, net maintenance \$198,082, and reimbursement \$105,517; and for agricultural departments an outlay of \$7,933, net maintenance \$50,450, and reimbursement \$39,176. The cost of outlay has been borne entirely by municipalities and counties and the cost of maintenance by municipalities, counties, and the State.

Nine all-day schools of home economics have been established with a total enrollment of 669 pupils, and embracing work in marketing, preparing and serving meals, buying, making, repairing, and caring for clothes, the furnishing and care of the home, the nurture and care of children, home nursing, application of art and literature in the development of the home, and nonvocational subjects for training in citizenship and general culture. The vocational programs of these schools have been required to occupy 80 per cent of the pupil's time, and the general improvement portion of the program the remaining 20 per cent. In a number of these schools substantial progress has been made in partly supervised and carefully organized home project work. Instruction in household arts in evening schools is also given. The total outlay for day household arts classes was \$132,542, net maintenance \$209,589, and reimbursement \$119,599; for evening household and practical art schools, total outlay \$6,679, net maintenance, \$138,776, and reimbursement \$71,476.

State-aided vocational agricultural education in 1916 (*Bul. Bd. Ed. Mass.*, No. 5 (1917), pp. 17).—This is a reprint of that portion of the preceding abstract relating to agricultural education.

A suggested course of study for county training schools for negroes in the South (*Trustees John P. Slater Fund Occas. Papers*, No. 18 (1917), pp. 73, 74, 56).—This publication embodies the report of a committee appointed at a meeting of State agents of rural schools for negroes held in Nashville, Tenn., in March, 1917. It contains outlines of industrial courses in (1) handwork, manual training, and shopwork, (2) home making, (3) drawing, and (4) nature study, gardening, and agriculture, as well as science courses in health, geography, and general science, and a description of the subjects given. The work is organized on the five-two-three plan, i. e., five years of primary work, two of elementary work, and three of secondary work.

The purpose of the primary work is to give a working knowledge of the "3 R's," manual dexterity, specially in handling and utilizing native materials, and an elementary knowledge of the common industries of the home and farm. Gardening is taught both to boys and girls for its educational value as an introduction to practical science and for its economic value in the home. Home garden and pig projects are recommended. The girls receive one year's instruction in sewing in the fourth year and one in cooking in the fifth year.

The object of the elementary course is to give a broader knowledge of the common-school studies, together with two years of practical training in industrial work for boys and girls. The agricultural work includes text-book work and field practice in the growing of some staple farm crops, while the course for girls includes sewing, cooking (including canning and preserving), and the care of the home. Corn and poultry home projects are recommended for boys and girls respectively.

In the last three years, or secondary course, the work is differentiated as a home-makers' course for girls, a farm-makers' course for boys, and the rural teacher-training course. The agricultural work is a continuation of that begun in the elementary course and includes a simple study of soils and fertilizers, the principle of crop rotation, the study of farm animals, feeds and the principles of feeding, common fruit trees, insect pests, and plant diseases. Instruction is also given in elementary farm blacksmithing, carpentry, brick laying, and concrete work. The girls' work consists of dressmaking, first aid, elementary nursing, the care of infants, preparation of family meals, and house planning and decoration. The work in teacher training consists of the principles of teaching and school and class management, with special reference to rural conditions and practice teaching.

The schools have increased from 8 in 1914 to 17 in 1915, 27 in 1916, and 42 in 1917. While the schools work under the immediate direction of the county school boards and superintendents, the State boards of education keep in close touch with them through the State agents of rural schools for negroes who serve the schools as advisors and supervisors. To aid in the establishment of these schools the trustees of the John F. Slater fund have voted an appropriation of \$500 to each for maintenance. The school property must belong to the State, county, or district, and the school be a part of the public school system. There must be an appropriation for maintenance of not less than \$750 from public funds raised by State, county, or district taxation, and the teaching must extend through the eighth year, with the intention of adding at least two years as soon as it shall be possible to make such extension. Nearly all of these schools have also been assisted in the past three years with appropriations from the General Education Board for equipment, particularly for industrial training.

Swine-judging suggestions for pig-club members, J. D. McVEAN and F. G. ASHBROOK (*U. S. Dept. Agr., Office Sec. Circ. 83 (1917), pp. 13, figs. 4*).—This circular, intended mainly for the beginner, contains a brief study of the lard and bacon types of swine and the market and breeding classes of hogs, an explanation of the principal points of the score card and its use, and suggestions for conducting judging contests.

MISCELLANEOUS.

Twenty-third Annual Report of Montana Station, 1916 (*Montana Sta. Rpt. 1916, pp. 151-193*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, and a report of the director on the work and publications of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-ninth Annual Report of Rhode Island Station, 1916 (*Bul. R. I. State Col., 12 (1917), No. 4, pp. 17-24, 32, 33*).—These pages include a report of the director and a financial statement for the fiscal year ended December 31, 1916. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Twenty-sixth, Twenty-seventh, and Twenty-eighth Annual Reports of Tennessee Station, 1913, 1914, 1915 (*Tennessee Sta. Rpt. 1913, pp. 139-164, figs. 9; 1914, pp. 265-287, figs. 6; 1915, pp. 111-133, figs. 9*).—These reports contain the organization lists, reports of the director and the various departments, the experimental features of which are for the most part abstracted elsewhere in this issue, and financial statements for the fiscal years ended June 30, 1913, 1914, and 1915.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 2 (1917), No. 11, pp. 349-383, figs. 15*).—This contains several articles abstracted elsewhere in this issue and notes.

NOTES.

Delaware College.—Howard T. Ruhl, State leader of boys' and girls' clubs, resigned January 1 to become professor of agricultural education under the Federal Vocational Education Aid Act and was succeeded by Theodore T. Martin.

Idaho University and Station.—*Breeders' Gazette* announces that Dean E. J. Sellings has been appointed head of all agricultural activities at the institution, including the station and extension work.

Purdue University.—A four-weeks' course in dairying has been offered to women to prepare them to fill positions in factories manufacturing dairy products. This course included the testing of milk and dairy products, the making of soft cheese and ice cream, dairy bacteriology, general dairying, and lectures on food production.

Maryland College and Station.—The resignations are announced of D. G. Sellings as associate animal husbandman to accept a position on the extension staff of the Connecticut College, S. E. Isacson, D. V. S., as animal pathologist in charge of the hog cholera serum laboratory to engage in commercial work, G. H. Cale as apiculturist to accept a position with the U. S. Department of Agriculture, C. E. Leathers as assistant botanist to become county agent of Lancaster County, J. M. Arthur as assistant plant pathologist to go into the Army, and O. C. Bruce as professor of soils to accept a commercial position as tractor demonstrator. L. W. Erdman has been appointed assistant in the soil laboratory, and Whitney J. Atcheson, assistant agronomist.

Minnesota University and Station.—The new beef cattle barn, to replace the structure burned last summer, is practically completed. It is 60 by 120 feet with a wing 36 by 120 feet. The portion to be used as a stable is built of hollow tiles with reinforced concrete. Above this, wood with stucco finish is used for the portion intended for storing feed and hay. Two hollow tile silos adjoin the stable, and the wing contains a laboratory for class work and demonstration. The total cost is about \$25,000.

Arrangements were made whereby students wishing to leave college prior to the close of the second semester could take double work in certain subjects up to April 15 and receive credit therefor. About 50 students registered for the special work thus provided.

The name of the division of economic zoology has been changed to that of entomology and economic zoology. Dr. William A. Riley, professor of insect morphology and parasitology at Cornell University, has been appointed professor of entomology and parasitology and chief of the division beginning February 1. A. G. Ruggles, associate professor of entomology and associate entomologist, has been made associate professor of entomology and station entomologist.

Three new courses in agricultural education are announced, beginning with the second semester. These deal respectively with agricultural statistics and graphic representation, the history of agriculture, and the visual presentation of material. W. H. Bender, associate professor of agricultural education, has resigned to become State director of vocational agricultural education in Iowa and secretary of the board of vocational education. Percy B. Barker, head of the department of agronomy at the University of Arkansas, B. M. Gile, and

Albert M. Field have been appointed assistant professors of agricultural education, and John V. Ankeney, instructor in that subject.

Other appointments include I. D. Charlton, extension professor of agricultural engineering at the Washington College, as assistant professor of farm mechanics beginning January 15; William A. Billings as assistant pathologist of the station, beginning February 1; Gibson G. McKnight as laboratory assistant in plant pathology; and Lionel H. Laurence as mechanic and laboratory assistant in agronomy and farm management.

Montana College and Station.—C. N. Arnett, head of the animal husbandry department, has been granted leave of absence for service in France with the American National Red Cross. It is understood that his work will have to do with the rehabilitation of the live-stock industry in France in the vicinity of the base hospitals. It is hoped to establish a farm near each hospital to be operated to some extent by partly crippled and convalescent soldiers.

Nevada University and Station.—Dr. Edward Records, assistant bacteriologist, has been appointed director of the State veterinary control service and chief of the department of veterinary science in the station, effective March 15. Dr. Lewis H. Wright, assistant professor of veterinary medicine at the Texas College, has been appointed assistant veterinarian in the station, effective April 15.

Dr. C. A. Jacobson, professor of agricultural chemistry and chemist, has resigned, effective June 30. N. F. Peterson, instructor in botany in the South Dakota College, has been appointed assistant in range management, and George Hardman, assistant agronomist, both appointments being effective April 1.

New York State Station.—Everett P. Reed, assistant agronomist, has resigned to accept an appointment as farm bureau agent in Ohio. George H. Howe, assistant horticulturist, has enlisted in the Medical Corps.

Rhode Island Station.—W. C. Irons, assistant in field experiments, and H. A. Johns, assistant in chemistry, have resigned to enter military service. F. K. Crandall has been appointed assistant in field experiments beginning March 1.

L. P. Howard, assistant in chemistry, died February 24, at the age of 25 years. He was a 1914 graduate of the Massachusetts College and had been in the employ of the station since graduation.

South Dakota College and Station.—James H. Shepard, professor of chemistry and station chemist since 1888, died February 21 in Florida at the age of 68 years. Prof. Shepard was a graduate of the University of Michigan in 1875, and for many years was engaged in high-school teaching and as superintendent of schools. He served as vice president of the college from 1890 to 1900 and was director of the station from 1895 to 1901. His textbook entitled *Elements of Chemistry*, appearing in 1885, has been extensively used, and he was also the author of a considerable number of bulletins dealing with the chemistry of forage plants, sugar beets, macaroni wheat, etc. He was a prominent witness for the Government in the bleached-flour cases, and well known as an expert on the chemistry of wheat and its products.

Washington College and Station.—A quarter section of land at Waterville has been leased for 20 years for carrying on forage and cereal investigations. R. Page Bledsoe, instructor in farm crops at the Kansas College, has been appointed specialist in forage crops in charge of this tract.

Dr. C. A. Magoon, associate professor of botany and bacteriology, resigned February 15 to accept a position with the Horticultural and Pomological Investigations of the U. S. Department of Agriculture. William Hislop resigned as animal husbandman, March 1, to engage in commercial work.

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